Advant® OCS
with Master software

MultiVendor Interface - MODBUS® with MVB and CI534V02

Advant® Controller 400 Series

User's Guide

3BSE 010 719R101

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Chapter 1 Introduction

1.1 Before You Begin

This manual describes asynchronous communication with the Gould Electronics protocol MODBUS in Advant Controller 400 Series (Advant Controller 410 and Advant Controller 450).

MODBUS in Advant Controller 400 is called MVI-MODBUS (MultiVendor Interface - MODBUS). You can use it for communication with, for example, other manufacturers' control systems (PLCs).

You can use MVI-MODBUS in point-to-point or multidrop type connections, see Figure 1-1. The Advant Controller 400 can act as either a master or slave station. MVI-MODBUS is available in RTU (binary) and ASCII mode.
The transmission speed is up to 19200 bits/s.Traffic on the MVI-MODBUS link is controlled by the master station. Direct communication is only possible between the master and the slaves. Stations connected via MVI-MODBUS appear in the Advant OCS system as stations in a MasterNet local control network.

This manual tells you how to configure and use MVI-MODBUS from the application programs, that is, the process data base and the PC programs, in the Advant Controller 400.
It is intended primarily for Advant OCS application builders, though it is also useful to commissioning and service engineers. To use it, you must be familiar with application building in the Advant Controller 400.

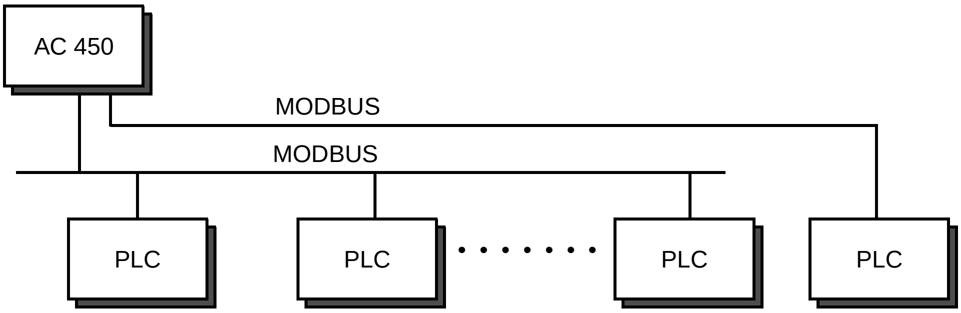


Figure 1-1. Example of a MVI-MODBUS Configuration

1.2 Equipment Requirements

Basic equipment requirements for MVI-MODBUS in the Advant Controller 400 are:

- Communication hardware in the Advant Controller 410
  - **CI534V02**
    Communication submodule for connection of two MVI-MODBUS links.

  The communication submodule is connected to one of the four submodule positions on the main processor module PM150.

- Communication hardware in the Advant Controller 450
  - **CI534V02**
    Communication submodule for connection of two MVI-MODBUS links.
  - A free submodule position for the CI534V02 submodule on one of the following submodule carriers:

    SC510
    Carrier without local processor.
    (You can also use one submodule position for other functions, that is, MB 300.)

    SC520
    Carrier with local processor for MB 300.
    (You can also use one submodule position for other functions, that is, MB 300.)

Modems and Cables

The communication submodule CI534V02 is equipped with two independent, CCITT V.24 (RS-232-C), asynchronous communication ports. To connect the MVI-MODBUS link, the following modems and cables are recommended:

- Westermo LA-01 [1]
  Full duplex modem for multidrop communication up to 10 km.
- TC562
  Full duplex modem for cable length up to 10 km. Point-to-point up to 1 km at 19200 bps. Power 24 V d.c.
- Uniline 2.4 [2]
  Modem for point-to-point connection more than 10 km or for switched telephone line.
- TK577
  TK577 is a 3 m cable with a DE9 socket for connection to one port on the front of the CI534V02 submodule and a DE25 PIN for connection to the modem LA-01 or Uniline 2.4.
- TK595
  Cable assemblies DE9 socket DE9 PIN connection to the modem TC562.
- Bus cable with two twisted pairs, each pair individually shielded, minimum conductor area 0.22 mm^2. You can use the following cable or a similar cable:
  - Belden Type 9406
  - Kabelmetal Type DUE 4552
  - Alpha Type 6032
  - Norsk Kabel Type O6802.

Engineering Tools

To build the data base and the PC program in the Advant Controller 400, you need an engineering station.

---

[1] Ordered from Westermo Teleindustri AB, Stora Sundby, Sweden

[2] Ordered from Standard Radio Telecom AB, Vällingby, Sweden

1.3 How to Use This Book

Figure 1-2 shows the basic structure of the Advant System's documentation. Each document, describing either hardware or software, is built around this structure to make it easy for you to locate related information in any of the document.

This book is organized into chapters and sections as shown in Figure 1-2.

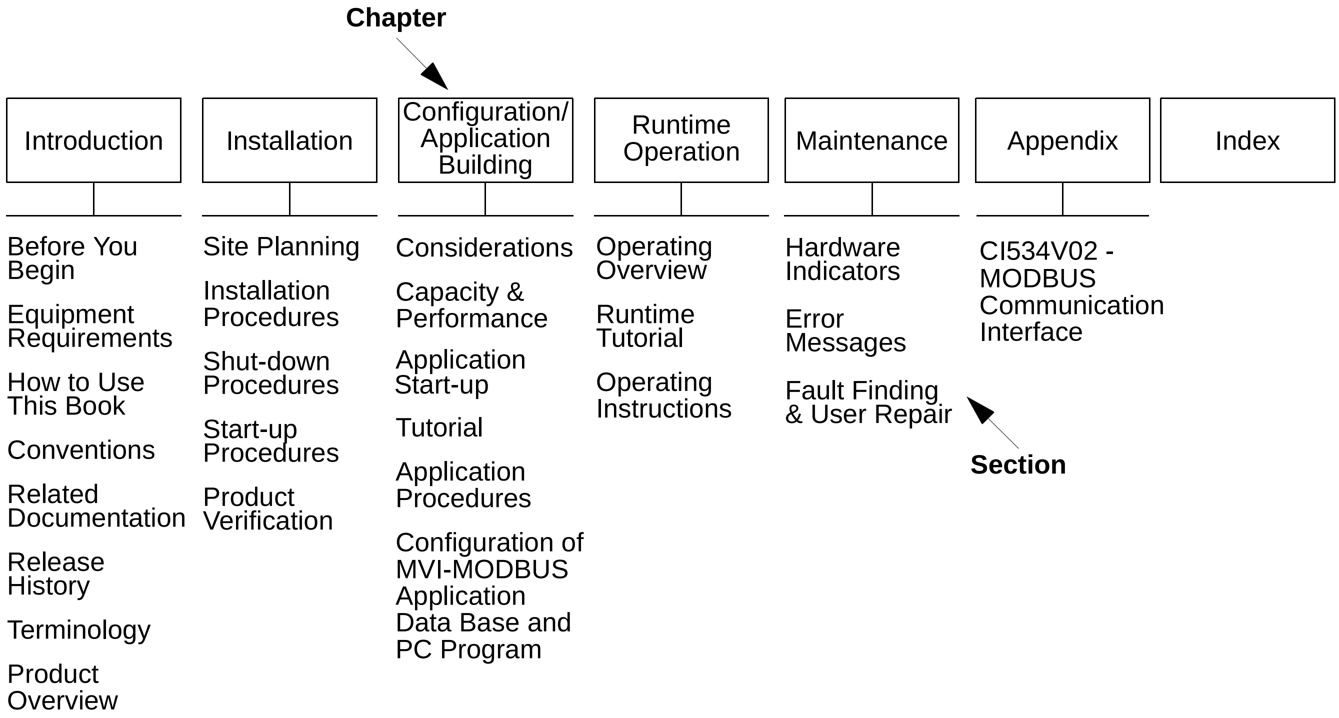


Figure 1-2. Organization of Manual

Introduction

This chapter describes MVI-MODBUS functions in the Advant Controller 400, system layout, hardware requirements, related documents, release history, terminology and the manual's organization.

Installation

Chapter 2, Installation, tells you how to set up the MVI-MODBUS communication hardware in the Advant Controller 400. You will also find descriptions of the shutdown and start-up procedures and how to verify correct operation after you power up.

Configuration and Application Building

Chapter 3, Configuration/Application Building describes how to configure the process data base, define commands for data exchange, store data and build the PC program for flow control on the communication link. You will find capacity and performance figures for the communication and an example of an application program in this chapter. Configuration of MVICHAN data base element and MVINODE data base element are also described.

Runtime Operation

In Chapter 4, Runtime Operation, you will find information on how to check the link status and how to activate the application for transmission of commands and data.

Maintenance

Chapter 5, Maintenance translates error messages from the MVI-MODBUS CI534V02 submodule. This chapter also describes a fault-finding procedure.

1.4 Conventions

Following conventions are used in this manual:

- All inputs to data base elements which require you to enter a value are **boldfaced**.
- References to other documents are in *italic*.
- Advant OCS is used for Advant Open Control System, with Master software, throughout this manual.

1.5 Related Documentation

Table 1-1 lists all documentation related to MultiVendor Interface - MODBUS concerning further information about application building.

NOTE

The delivery binder includes a document, *Release Notes*, which comprise the latest product information not covered by the standard user documentation listed below. You may find, for example, additionals, changes, limitations, alerts, and so on.

Table 1-1. Related Documentation

Category	Title	Description
System Products	Advant Controller 410 User's Guide	This manual provides information about the Advant Controller 410 system, its capabilities and its limitations.
	Advant Controller 450 User's Guide	This manual provides information about the Advant Controller 450 system, its capabilities and its limitations.

Table 1-1. Related Documentation (Continued)

Category	Title	Description
Configuration/ Application Building	AMPL Configuration Advant Controller 400 Series Reference Manual	Instructions for the configuration and application programming of Advant Controller 410/450 systems using Advant Station 100 Series ES. Commands for diskette handling are described in the User's Manual on the tool concerned.
	Data Base Elements Advant Controller 400 Series Reference Manual	Data for all data base elements in Advant Controller 410/450.
	PC Elements Advant Controller 400 Series Reference Manual	PC Elements Advant Controller 400 Series Reference Manual
	Source Code Handling User's Guide	This manual contains description of and instructions for source code handling of PC programs and data bases. It contains instructions for designing source code, editing, loading and dumping and correcting defective programs.
Options	MasterNet User's Guide	Manual describing how to configure, install and maintain MasterNet communication networks, MasterBus300, MasterBus 300E and GCOM.
Other	Gould MODBUS Protocol Reference Guide PI-MBUS-300 Rev. D	This book from Gould Electronics provides detailed information about Gould MODBUS Protocol.

1.6 Release History

Table 1-2 lists the development of MVI-MODBUS with CI534V02 Release History.

Table 1-2. Release History

Version	Description
1.0	Initial Release for Advant Controller 400 Series.

1.7 Terminology

AC 400 is an abbreviation for Advant Controller 400 Series (Advant Controller 410 and Advant Controller 450).

AMPL is an abbreviation for the ABB Master Programming Language. AMPL is a function-block language with graphic presentation which is especially oriented towards process control. The AMPL is used for configuration and application building in Advant Controllers.

Controller refers to Advant Controllers.

DAT is a concept in the data base that holds a data value (one Real (4 bytes), one Integer (2 or 4 bytes) or 32 Boolean values). The data values for MVB references are held by connected DAT elements.

NOTE

MVI-MODBUS only supports DAT elements with 2 byte Integers or 32 Boolean values.

DB is an abbreviation for data base.

MB 300/300E or MasterBus 300/300E is a high-speed bus used to interconnect Controllers, Operator Stations and Communication Stations in Advant OCS.

MVB (**M**ulti**V**endor Interface Data **B**lock) is the data base element defining the command used for control of slaves and is also the data base element used for data transfer. It is used for transfer of block of data in an Advant OCS network.

MVI is an abbreviation for Advant OCS MultiVendor Interface.

PC program (Process Control program) is a program written in AMPL.

PLC is an abbreviation for Programmable Logic Controller (for example, Gould Modicon 484 Controller).

Poll messages (idle traffic) are cyclically sent from a MVI-MODBUS master node to the slave nodes when nothing else is transferred on the MVI-MODBUS link (cycle time can be configured).
The poll messages are necessary for supervision of the link status. The MODBUS Function code 8 (Diagnostic loop-back) is used as a poll message.

RTU is an abbreviation for Remote Terminal Unit.

A number of different names are used for values handled in the MODBUS protocol. This is a short description of the different names and their meanings:

Table 1-3. Values used in MODBUS

MODBUS	Advant Controller 400
Coil status	Digital output - one Boolean in a DAT(B)
Output status	Digital output - one Boolean in a DAT(B)
Input status	Digital input - one Boolean in a DAT(B)
Holding registers	Analog output - one Integer DAT(I)
Output registers	Analog output - one Integer DAT(I)
Input register	Analog input - one Integer DAT(I)
Single coil	Digital output - one Boolean in a DAT(B)
Multiple coils	Digital outputs - multiple Boolean in a DAT(B)
Multiple registers	Analog outputs - multiple Integer DAT(I)s

1.8 Product Overview

MVI-MODBUS in the Advant Controller 400 provides communication capabilities using multidrop or point-to-point. Traffic on a MVI-MODBUS link is controlled by a master station. Direct communication is possible only between the master and the slaves. MVI-MODBUS in Advant Controller 400 consists of three parts:

- **PC program** (Process Control program), written in AMPL, is used to define and control the data flow on the link.
- Advant OCS process **data base** is used to configure the communication submodule, CI534V02, and to store the data.
- **CI534V02** communication submodule runs the MVI-MODBUS protocol in the Advant Controller 400.

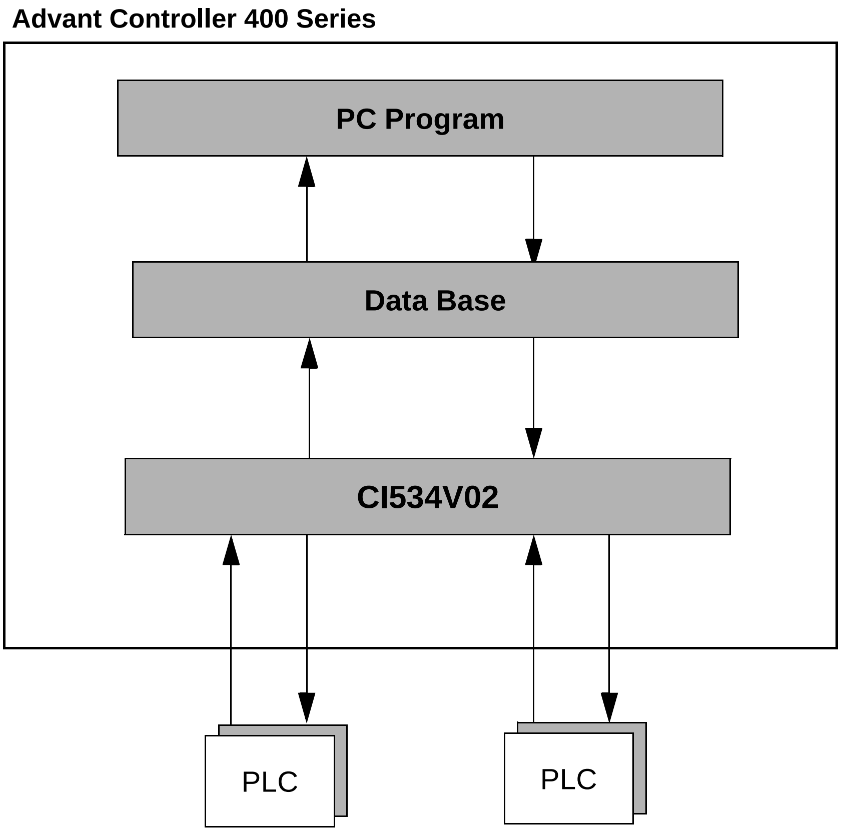


Figure 1-3. Overview of MVI-MODBUS in Advant Controller 400

CI534V02 submodule is installed in the central subrack of the Advant Controller 400. The CI534V02 submodule is equipped with two independent, asynchronous communication ports for MVI-MODBUS communication. You can configure the ports as either master or slave on the MVI-MODBUS link. The setup of each port is individually defined by a number of data base elements, see Section 3.6, Configuration of MVI-MODBUS Application Data Base and PC program.

Each port forms a local control network within the Advant OCS system with the network numbers 1 to 9. In master mode, CI534V02 submodule can handle a total of 55 slave nodes, divided on two ports. One single port can handle up to 32 slave nodes. Since every PLC on the MVI-MODBUS bus is part of an Advant OCS control network, each node (including the master node) must have a unique node number, 1 to 99, within the controller concerned.

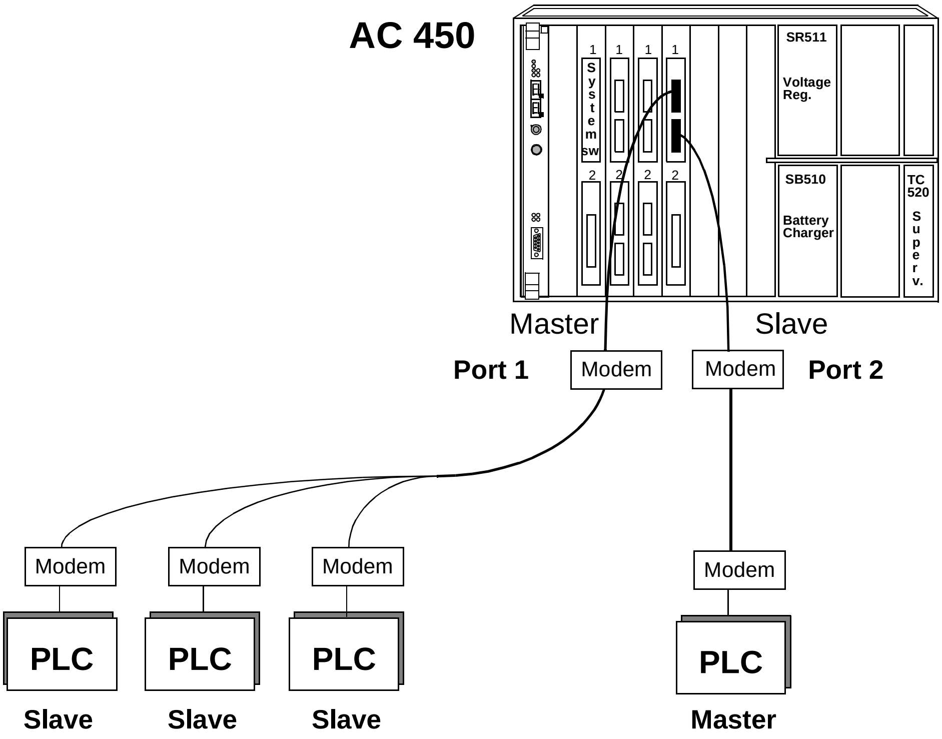


Figure 1-4. MVI-MODBUS Configuration Example

1.8.1 Functionality

The following MODBUS functions are implemented in the CI534V02 submodule:

- **Read output status (Function code 1)**
  Update bits in Boolean DATs from a slave.
- **Read input status (Function code 2)**
  Update bits in Boolean DATs from a slave.
- **Read output registers (Function code 3)**
  Update Integer DATs from a slave.
- **Read input registers (Function code 4)**
  Update Integer DATs from a slave.
- **Force single coil (Function code 5)**
  Send one bit in a Boolean DAT to a slave.
- **Preset single register (Function code 6)**
  Send one Integer DAT to a slave.

- **Read exception status (Function code 7)**
  Get PLC Status (master mode only).
- **Diagnostic loopback (Function code 8)**
  Used for idle traffic poll messages (for internal use).
- **Force multiple coils (Function code 15)**
  Send bits from Boolean DATs to a slave.
- **Preset multiple registers (Function code 16)**
  Send Integer DATs to a slave.

The MVI-MODBUS implementation is made with both ASCII and RTU (binary) mode (the two ports can work in different modes). The functionality of the protocol is a **subset** of the MODBUS function codes.

For information about the configuration, refer to Section 3.6.1, Data Base Elements for MVI-MODBUS Configuration.

For more detailed information about the MODBUS protocol, see manual, *Gould MODBUS Protocol Reference Guide PI-MBUS-300 Rev. D.*

1.8.2 Functional Overview

The application building you will require in order to use MVI-MODBUS consists of two main parts; the PC program and the data base (see Figure 1-5).

PC Program

Use the PC program to control the data flow and status of the PLC. All MVB data base element (see below) are activated from the PC program.

Data Base

The necessary data base input for the CI534V02 submodule is defined with configuration data base elements and data transfer data base elements.

The data base is divided into two parts: Configuration elements (MVIMOD, MVICHAN and MVINODE) and data transfer data base elements (MVB).

- **Configuration data base elements (MVIMOD, MVICHAN and MVINODE)**

  MVIMOD data base element is used to set up the two ports on the CI534V02 submodule, see Section 2.2, Installation Procedures

  MVICHAN (defines transmission speed, time-out times, and so on), **MVINODE** represents a node on the MODBUS link (one element for each node), and holds the status information for the node.

- **Data transfer data base elements MVB**

  Specifies commands and holds data to control slaves when the CI534V02 is used in master mode. Holds data when the CI534V02 submodule is used in slave mode.

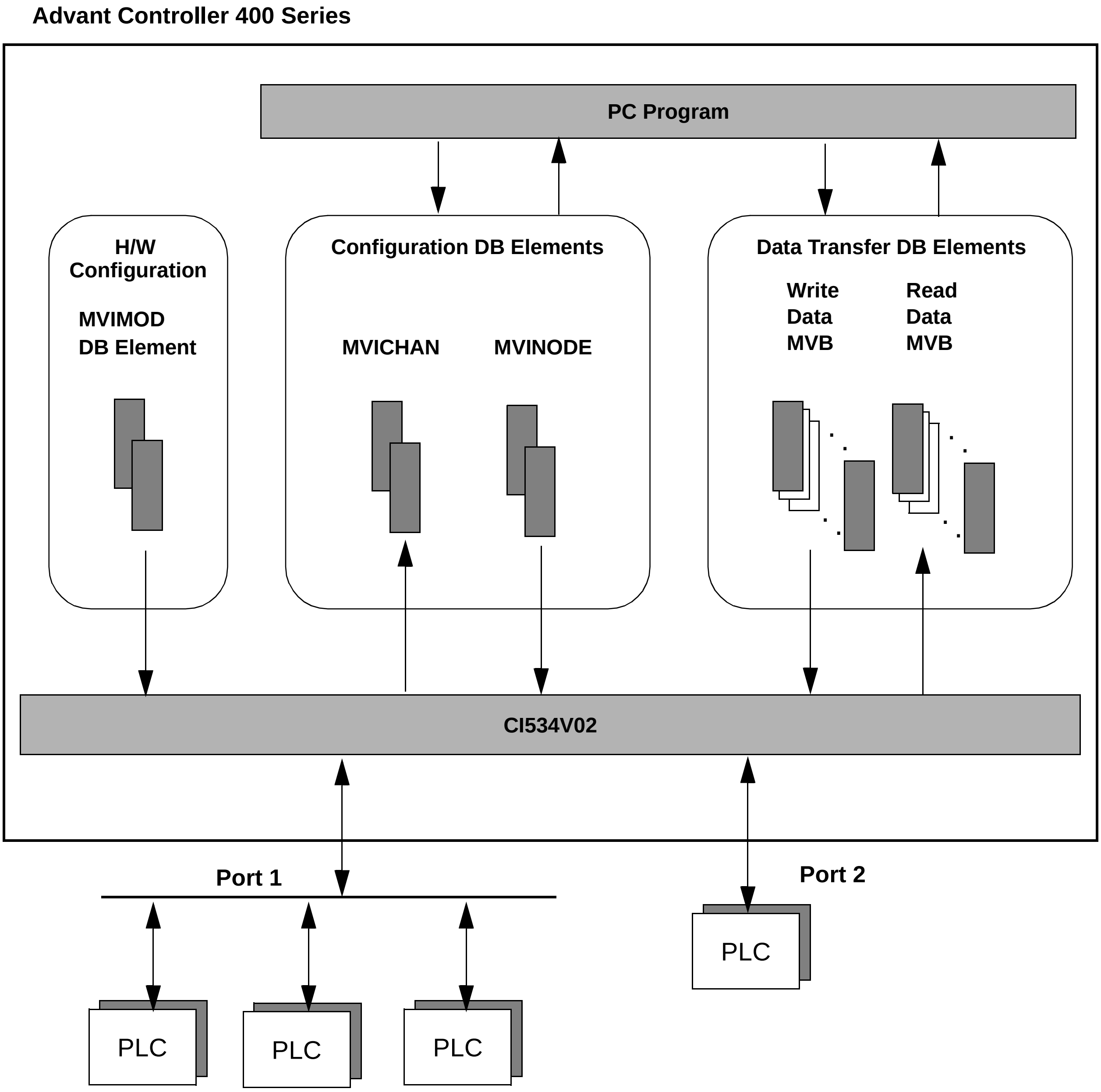


Figure 1-5. Functional Overview in the Advant Controller 400 for MVI-MODBUS

1.8.3 Initiating a Connection

At start-up, all the configuration data base elements are automatically sent down to the CI534V02 submodule. The CI534V02 reports application errors if it does not receive all of the necessary configuration data base elements or if they contain illegal parameters.

The node is ready for initiation of the connection when the configuration data base elements are received, the data base element MVIMOD for the CI534V02 submodule is correctly set up and the correct modem signals are received from the modem. If full duplex mode is used, Data Set Ready (DSR), Data Carrier Detect (DCD) and Clear to Send (CTS) must be set. The current values of DSR, DCD and CTS are available in the MVICHAN data base element.

The CI534V02 submodule always restarts if the Advant Controller 400 is restarted.

1.8.3.1 Master Mode

The CI534V02 submodule sends a message with Function code 8 to the slaves (that is, a poll message). If a response is received with Function code 8 or H'88 (exception response), a connection is established between the CI534V02 submodule and the responding slave. In all other cases, there will be no initiation of the connection between master and slave.

In master mode, the CI534V02 submodule cyclically sends poll messages when nothing else is transferred on the link. Poll cycle time is specified in the MVICHAN data base element.

1.8.3.2 Slave Mode

The CI534V02 submodule receives a message from the master. Depending on the address and Function code, the following happens.

- **If the message is addressed to the slave and**
  - Function code = 8:
    The slave initiates the connection with the master and responds with the same message.
  - Function code = 1, 2, 3, 4, 5, 6, 7, 15 or 16:
    The slave initiates the connection with the master and prepares for the next message.
  - Other Function codes:
    The slave responds to the master with illegal Function code (exception response). No connection is initiated between slave and master.
- **If all slaves are addressed (broadcast) and**
  - Function code = 5, 6, 8, 15 or 16:
    The slave initiates the connection with the master and prepares for the next message.

1.8.4 Data Transfer in Master Mode

All data transmission in master mode is handled by a number of MVB data base elements used to define the data to transmit or request. See Section 1.8.4.1, Transmission of Data and Section 1.8.4.2, Request for Data for an overview of these functions.

A maximum of 125 Integer registers (DAT(I), that is, 16 bit Integer) or 2000 Boolean registers (32 Boolean in a DAT(B)) can be transmitted on each command.

1.8.4.1 Transmission of Data

The indications **(1)**, **(2)**, **(3)**, and so on, in the text below refer to identical indications in Figure 1-6.

For the transmission of data from Advant Controller 400 to a MODBUS slave, a number of MVB data base elements are used to command the CI534V02 submodule to handle the data transfer.

Each MVB data base element contains information on what data and how much to transfer. It also holds the actual data.

The PC program with the SENDREQ element activates **(1)** the sending of the MVB data base element, which holds the write command and data, from the Advant Controller 400 to the CI534V02 submodule. CI534V02 interprets the write command, converts the command and data **(2)** to MODBUS format and transmits **(3)** to the destination PLC. The PLC receives the message **(4)** and replies to the CI534V02 submodule **(5)**. The CI534V02 submodule **(6)** sends the reply message to the Advant Controller 400.

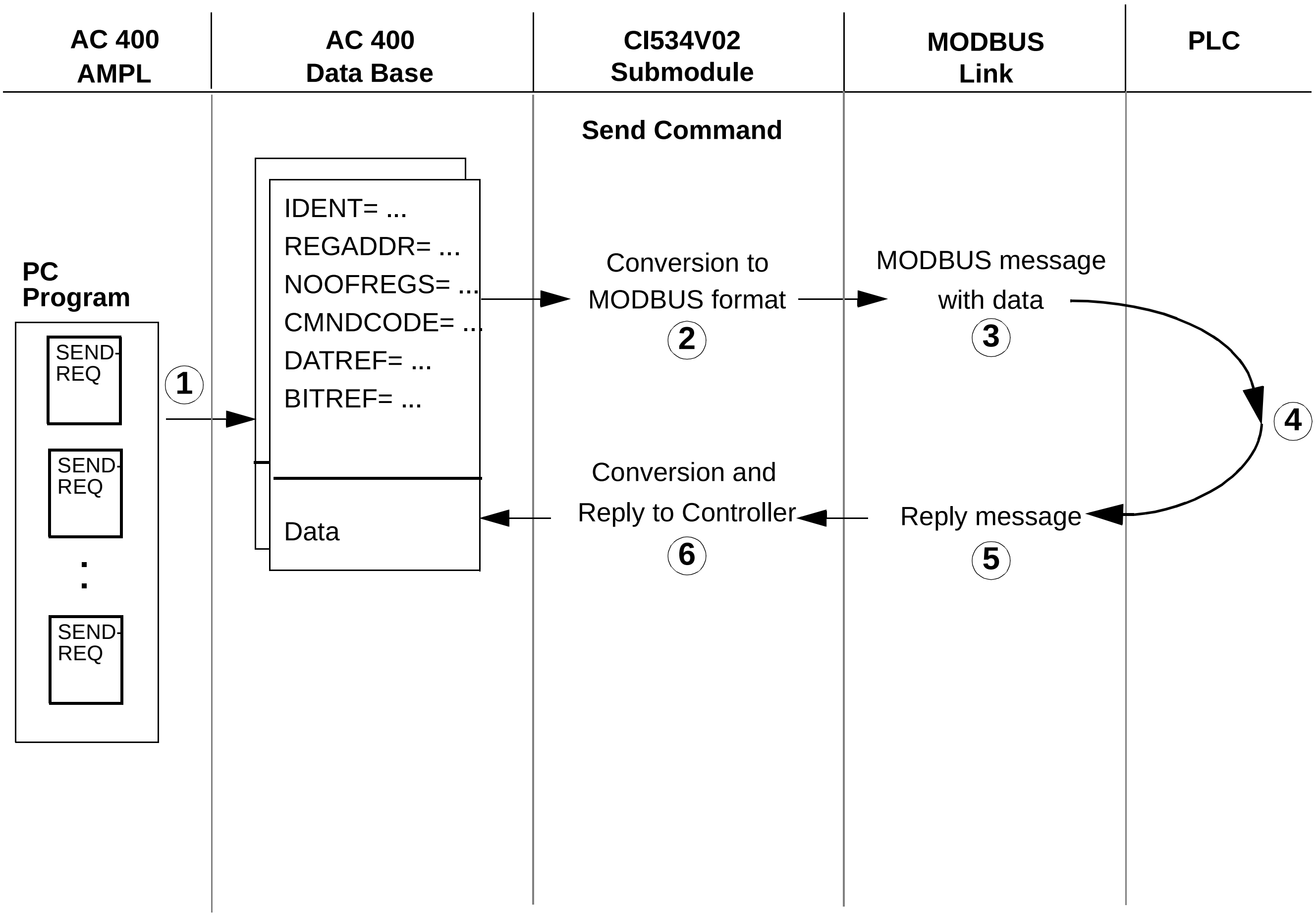


Figure 1-6. Data Transmission in Master Mode, Block Diagram

1.8.4.2 Request for Data

The indications **(1)**, **(2)**, **(3)**, etc., in the text below refer to identical indications in Figure 1-7.

To request data from a MODBUS slave to Advant Controller 400, a number of MVB data base elements are used to command the CI534V02 submodule to handle the data request.

Each MVB data base element contains information on what and how much data to receive. It also holds the received data.

The PC program with the SENDREQ element activates **(1)** the sending of the MVB data base element, which holds the read command and data, from the Advant Controller 400 to the CI534V02 submodule. The CI534V02 submodule interprets and converts the read command **(2)** to MODBUS format and transmits **(3)** to the destination PLC. The PLC receives the message **(4)** and replies with data to the CI534V02 submodule **(5)**. The CI534V02 submodule **(6)** sends the reply with data to the Advant Controller 400, which maps the data on the data part of the MVB.

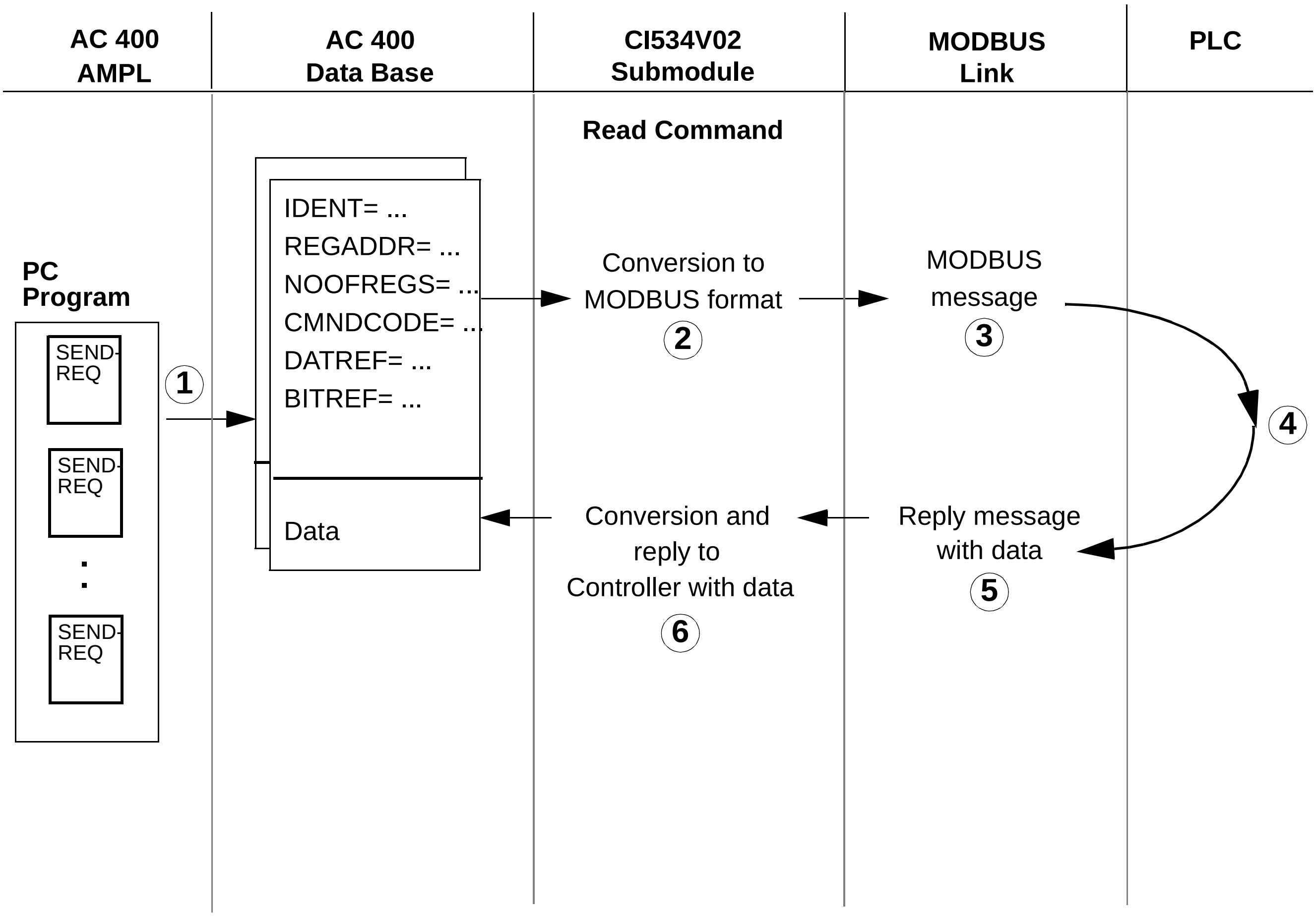


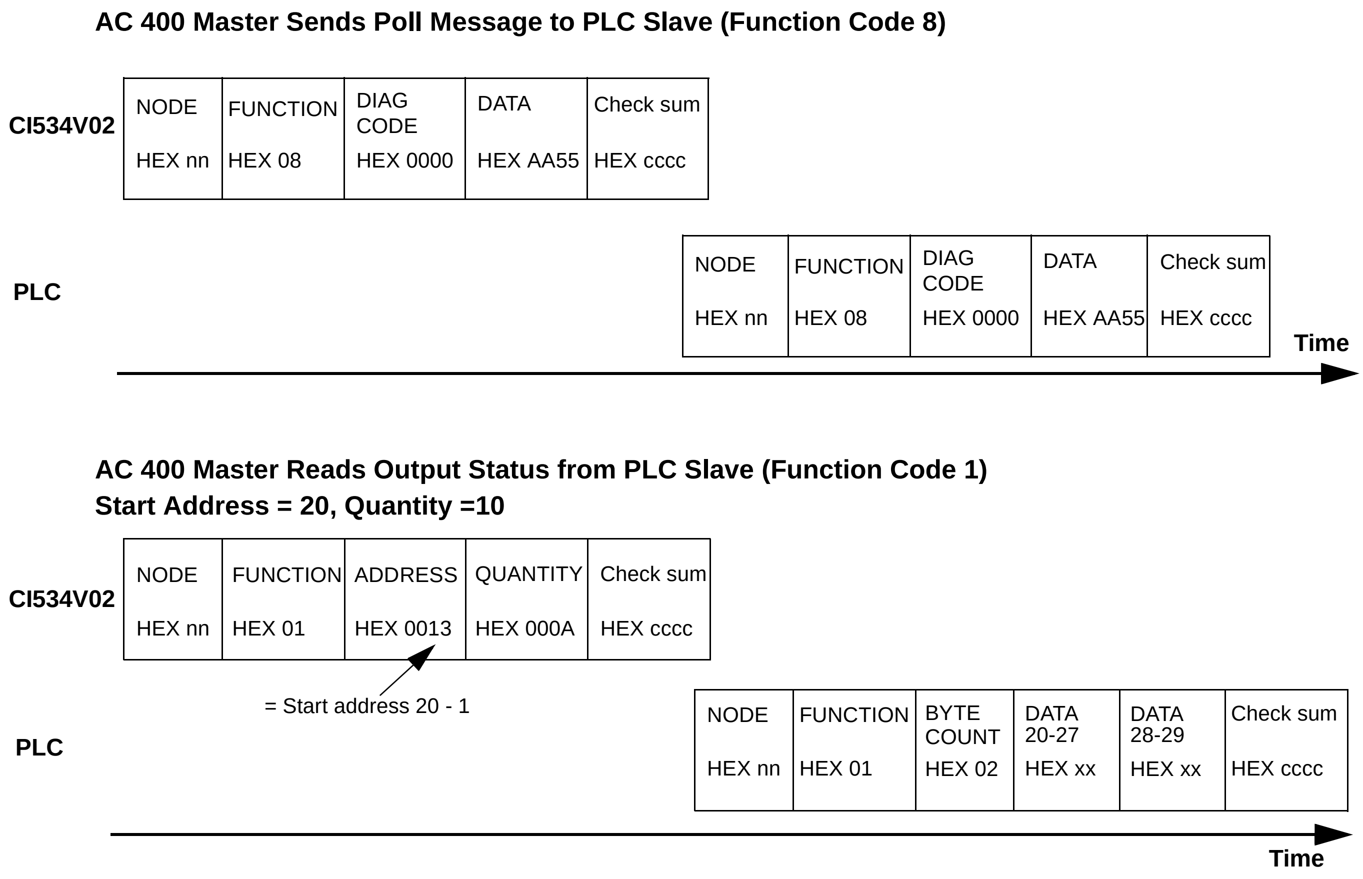
Figure 1-7. Data Reception in Master Mode, Block Diagram

1.8.5 Data Transfer in Slave Mode

All data transmission in slave mode is handled by the master on the MODBUS link. The master writes data to the slave(s) and requests data from the slave(s). It is only necessary to build the configuration data base elements MVIMOD, MVICHAN, MVINODE and the MVB's, which hold the data to be transferred, when the CI534V02 submodule is used in slave mode. See Section 3.5.2, Slave Functions.

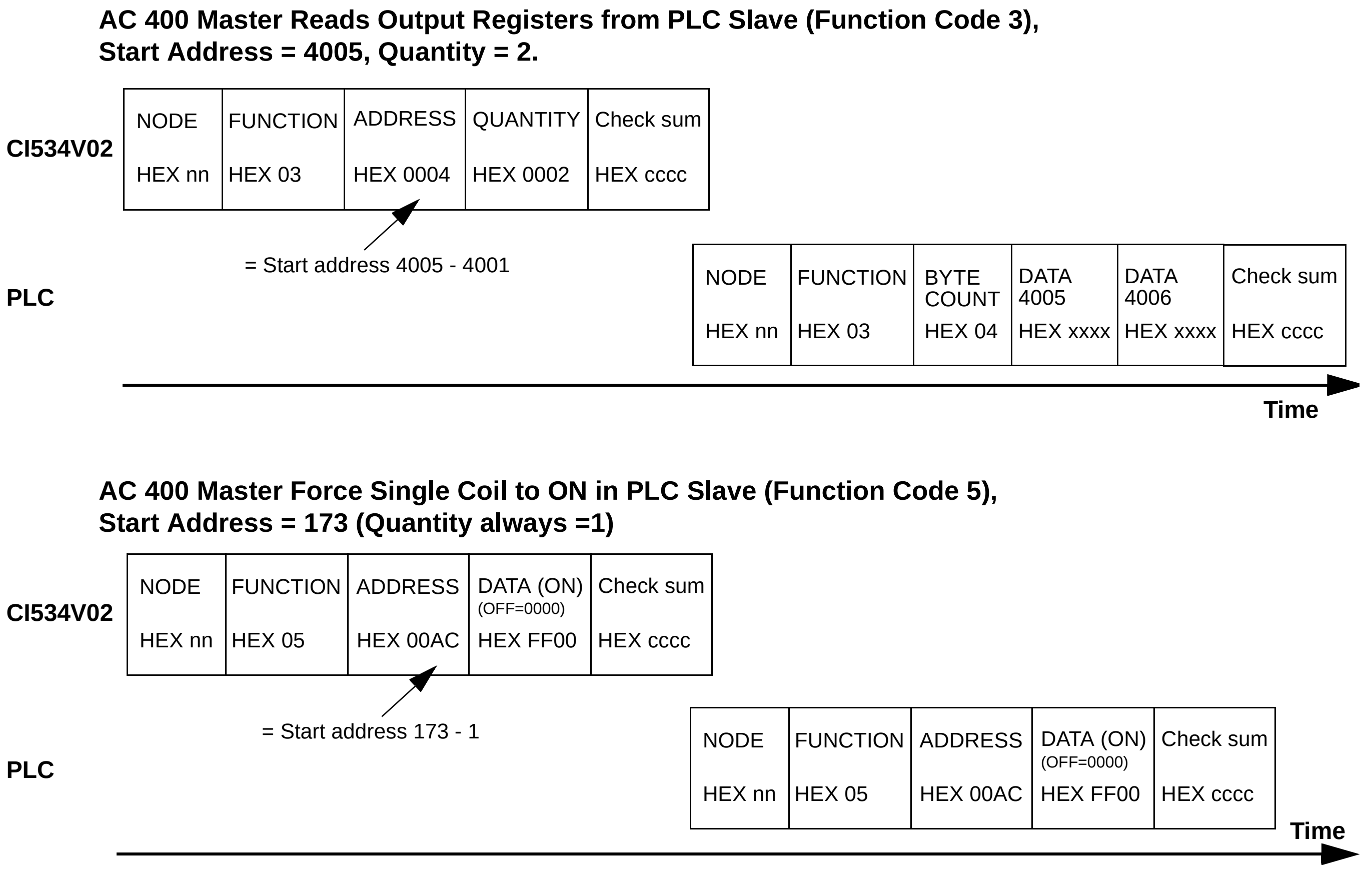
1.8.6 Message Flow on the Link

The following messages flow on the link when Advant Controller 400 is the master on the link and sends Function codes 8, 1, 3 and 5 to the slave with node number "nn".


AC 400 Master Sends Poll Message to PLC Slave (Function Code 8)

AC 400 Master Reads Output Status from PLC Slave (Function Code 1)
Start Address = 20, Quantity =10

Figure 1-8. Function Code 8 and Function Code 1



AC 400 Master Reads Output Registers from PLC Slave (Function Code 3), Start Address = 4005, Quantity = 2.

CI534V02

NODE	FUNCTION	ADDRESS	QUANTITY	Check sum
HEX nn	HEX 03	HEX 0004	HEX 0002	HEX cccc

= Start address 4005 - 4001

PLC

NODE	FUNCTION	BYTE COUNT	DATA 4005	DATA 4006	Check sum
HEX nn	HEX 03	HEX 04	HEX xxxx	HEX xxxx	HEX cccc

Time

AC 400 Master Force Single Coil to ON in PLC Slave (Function Code 5), Start Address = 173 (Quantity always =1)

CI534V02

NODE	FUNCTION	ADDRESS	DATA (ON) (OFF=0000)	Check sum
HEX nn	HEX 05	HEX 00AC	HEX FF00	HEX cccc

= Start address 173 - 1

PLC

NODE	FUNCTION	ADDRESS	DATA (ON) (OFF=0000)	Check sum
HEX nn	HEX 05	HEX 00AC	HEX FF00	HEX cccc

Time

Figure 1-9. Function Codes 3 and 5.

1.8.6.1 Flow Control

A PC program controls the data flow on the two asynchronous ports by means of the PC element SENDREQ and status information received from the CI534V02 submodule.

You can block the SENDREQ PC elements through the status bits “Ready for Message” and “Link status” in the MVINODE data base element for the PLC concerned. The “Ready for Message” flag blocks the SENDREQ PC elements if data flow from the PC program exceeds the capacity of the link. This function automatically controls the flow.

Chapter 2 Installation

2.1 Site Planning

See the *Advant OCS Installation Rules* manual for guidelines on grounding, power supply, and so on.

2.2 Installation Procedures

The MVI-MODBUS submodule CI534V02 is equipped with two independent, CCITT V.24 (RS-232-C), asynchronous communication ports, see Figure 2-1.

- In Advant Controller 410 the CI534V02 submodule is connected to one of the four submodule positions on the main processor module PM150, see Figure 2-5.
- In Advant Controller 450 the CI534V02 submodule is connected to a free submodule position on one of the following submodule carriers; SC510 or SC520. Figure 2-1 shows two CI534V02 submodules connected to a SC510 carrier.

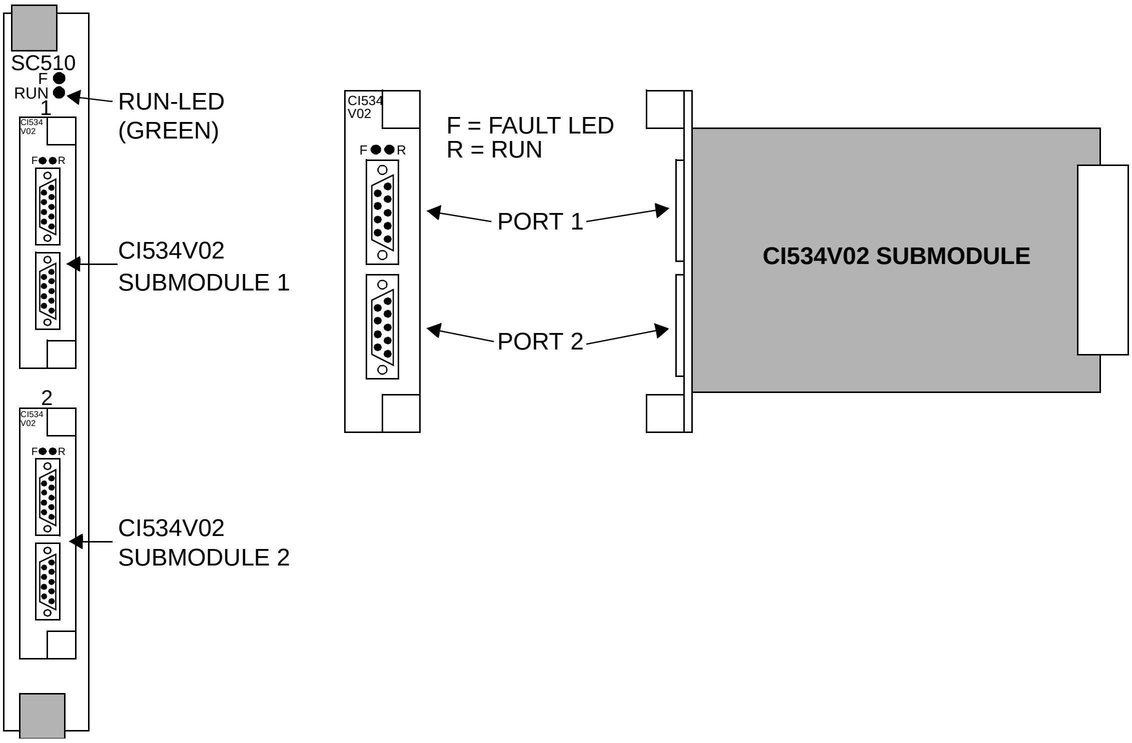


Figure 2-1. SC510 Carrier and CI534V02 Submodule

MVI-MODBUS communicates with other units in a proprietary, local control network. Valid network numbers for a local control network are 1 to 9. The Advant Controller 400, and every PLC connected to MVI-MODBUS, must have a node number, 1 to 99, which is unique within the controller. Modems and cables must be correctly installed. Figure 2-8 shows an example of necessary modems and cables in a MVI-MODBUS point-to-point connection.

Hierarchy of MVI Data Base Elements

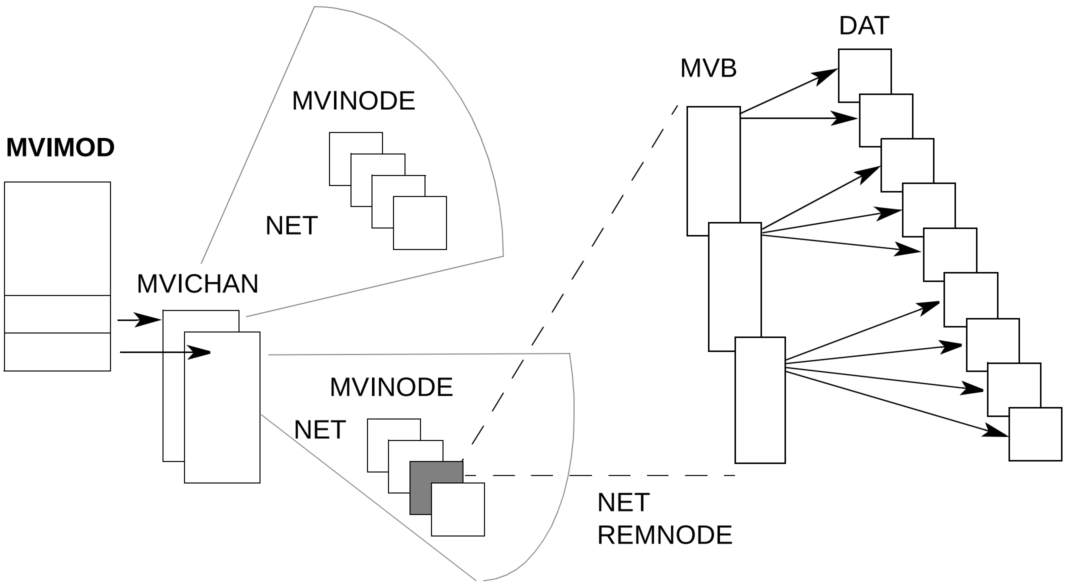


Figure 2-2. Hierarchy of MVI Data Base Elements

The setup for each port on the CI534V02 submodule is made with the data base element MVIMOD [1]. There are no strappings on the CI534V02 submodule and no strappings on the carrier boards SC510 and SC520.

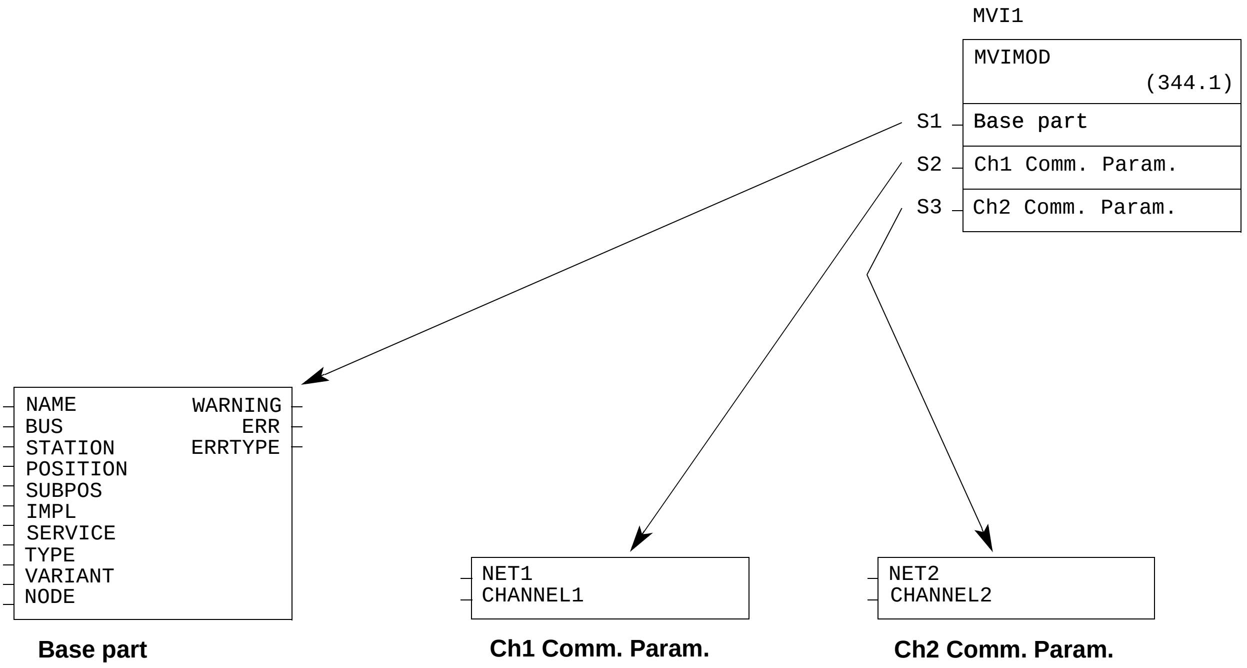


Figure 2-3. Overview of the MVIMOD Data Base Element

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[1] The call name for the data base element is MVIMOD and the element type is MVI.

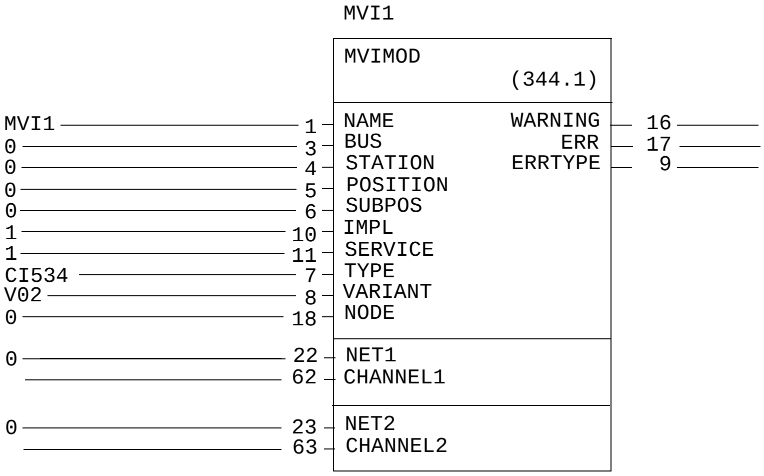


Figure 2-4. Data Base Element MVIMOD for MVI-MODBUS Communication Submodule CI534V02

You must check or fill in correct values on the MVIMOD data base element (Element type is MVI and call name is MVIMOD). For further description, please refer to the *Data Base Elements Advant Controller 400 Series Reference Manual.*

Table 2-1. Properties for the Data Base Element MVIMOD

Terminal No.	Terminal	Value in AC450	Value in AC410	Description
-	MVIMOD Record number	1-5	1-2	CI534V02 submodule number. Record number for the MVIMOD data base element for the MVI-MODBUS port defines the submodule number. Submodule numbers 1 - 5 are reserved to other modules than MVI. Record No 1 => submodule = 7 Record No 2 => submodule = 8 Record No 3 => submodule = 9 (only valid for AC450) Record No 4 => submodule = 10 (only valid for AC450) Record No 5 => submodule = 11 (only valid for AC450)
1	NAME			Unique **NAME** of the element.
3	BUS	0	0	Not used
4	STATION	0	0	Not used
5	POSITION	2-8	1	**POSITION** of the carrier board in the CPU rack, see figure below. To change the POSITION in operation mode, the IMPL must be set to 0. See Figure 2-5 and Figure 2-6.

Table 2-1. Properties for the Data Base Element MVIMOD (Continued)

Terminal No.	Terminal	Value in AC450	Value in AC410	Description
6	SUBPOS	1-2	1-4	**SUBPOS**ition on the carrier board, see figure below. To change the SUBPOS in operation mode, the IMPL must be set to 0. See figure below.
10	IMPL	1	1	**IMPL**emented = 1 to set CI534V02 submodule in normal operation 0 = the module is spare
11	SERVICE	1	1	To restart the communication module set the terminal **SERVICE** to 0 and back to 1.
7	TYPE	CI534	CI534	Always CI534
8	VARIANT	V02	V02	V02 = MVI-MODBUS
18	NODE	1-99	1-99	Set to AC 400's own node number. If node number of the AC 400 is already defined, NODE can only be set to that node number. In order to modify a node number >0, a COLD START of the AC 400 is necessary.
16	WARNING	0-1	0-1	**WARNING** flag indicating non-fatal errors. PC connection data type = B(r)
17	ERR	0-1	0-1	**ERR**or flag indication hardware or configuration error. PC connection data type = B(r).
9	ERRTYPE	0-n	0-n	**ERR**or **TYPE**. See Section 5.2, Error Messages for translation. PC connection data type I(r).
22 23	NET1 NET2	0-9	0-9	Local control **NET**work number for port **1** and **2**. In order to modify the already set network number, a COLD START of the AC 400 is necessary. All local control network numbers in the AC 400 must be unique. Use NET'n' = 0 if the port 'n' is not used.
62 63	CHANNEL1 CHANNEL2	- -	- -	Name of corresponding MVICHAN elements.

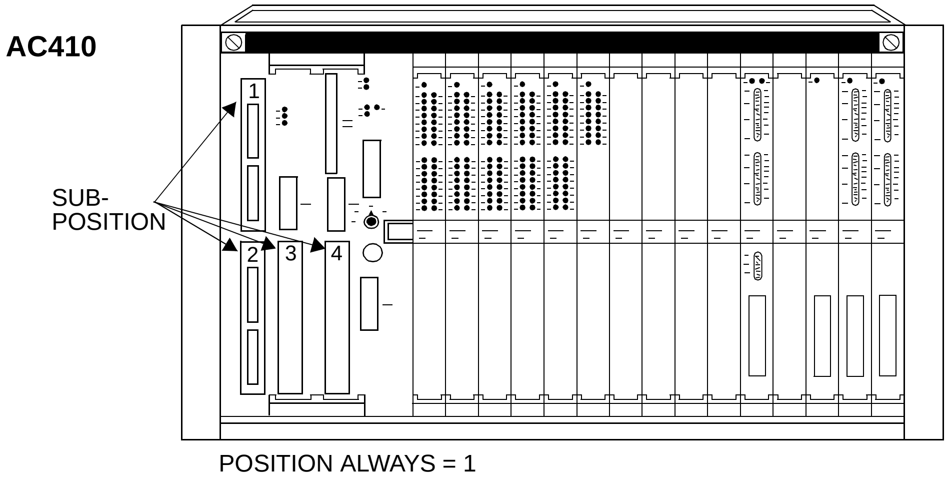


Figure 2-5. Position and Subposition for CI534V02 Submodule in Advant Controller 410

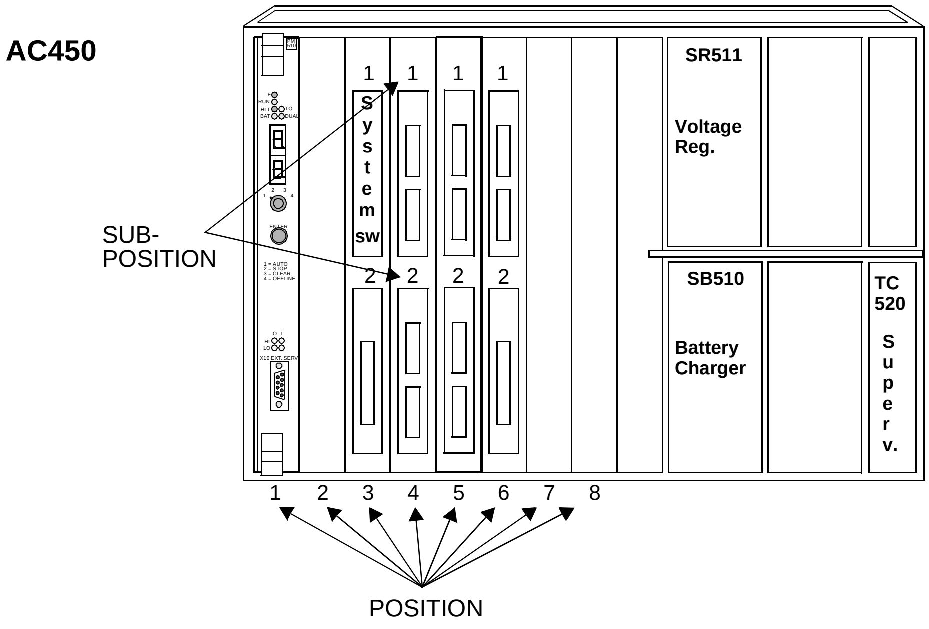


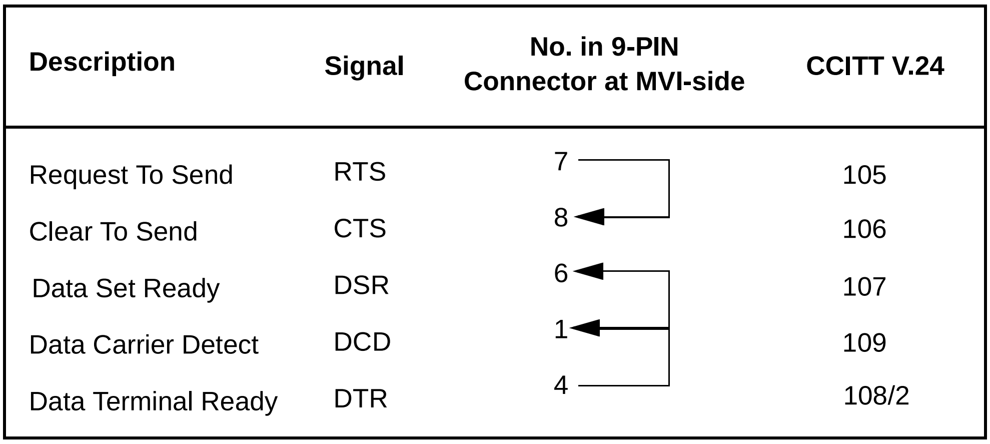
Figure 2-6. Position and Subposition for CI534V02 Submodule in Advant Controller 450

The cable TK577 has a DE9 socket for connection to one port on the front of the CI534V02 submodule and a DE25 PIN for connection to the modem. The connection between the nine- and the 25-pin connectors is shown in Table 2-2. No wiring of the modem signals is made in the cable TK577. The cable TK595 has a DE9 socket for connection to one port of the CI534V02 submodule and a DE9 PIN for connection to the modem.

Table 2-2. Description of Connections According to CCITT V.24

Description	**Signal**	**No. in 9- PIN Connector**	**No. in 25-PIN Connector**	**CCITT V.24**	**Direction** IN ← → OUT
Data Carrier Detect	DCD	1	8	109	←
Receive Data	RD	2	3	104	←
Transmit Data	TD	3	2	103	→
Data Terminal Ready	DTR	4	20	108/2	→
Signal Ground	SG	5	7	102	↔
Data Set Ready	DSR	6	6	107	←
Request To Send	RTS	7	4	105	→
Clear To Send	CTS	8	5	106	←
Ring Indicator	RI	9	22	125	←

If the MVI-MODBUS port is set up for full duplex handling of modem signals, the cable TK577/TK595 can be wired as shown in the Figure 2-7. The setup of modem signals can also be strapped in the modems.



Description	**Signal**	**No. in 9-PIN Connector at MVI-side**	**CCITT V.24**
Request To Send	RTS	7	105
Clear To Send	CTS	8	106
Data Set Ready	DSR	6	107
Data Carrier Detect	DCD	1	109
Data Terminal Ready	DTR	4	108/2

Figure 2-7. Wiring for Full Duplex Handling of Modem Signals.

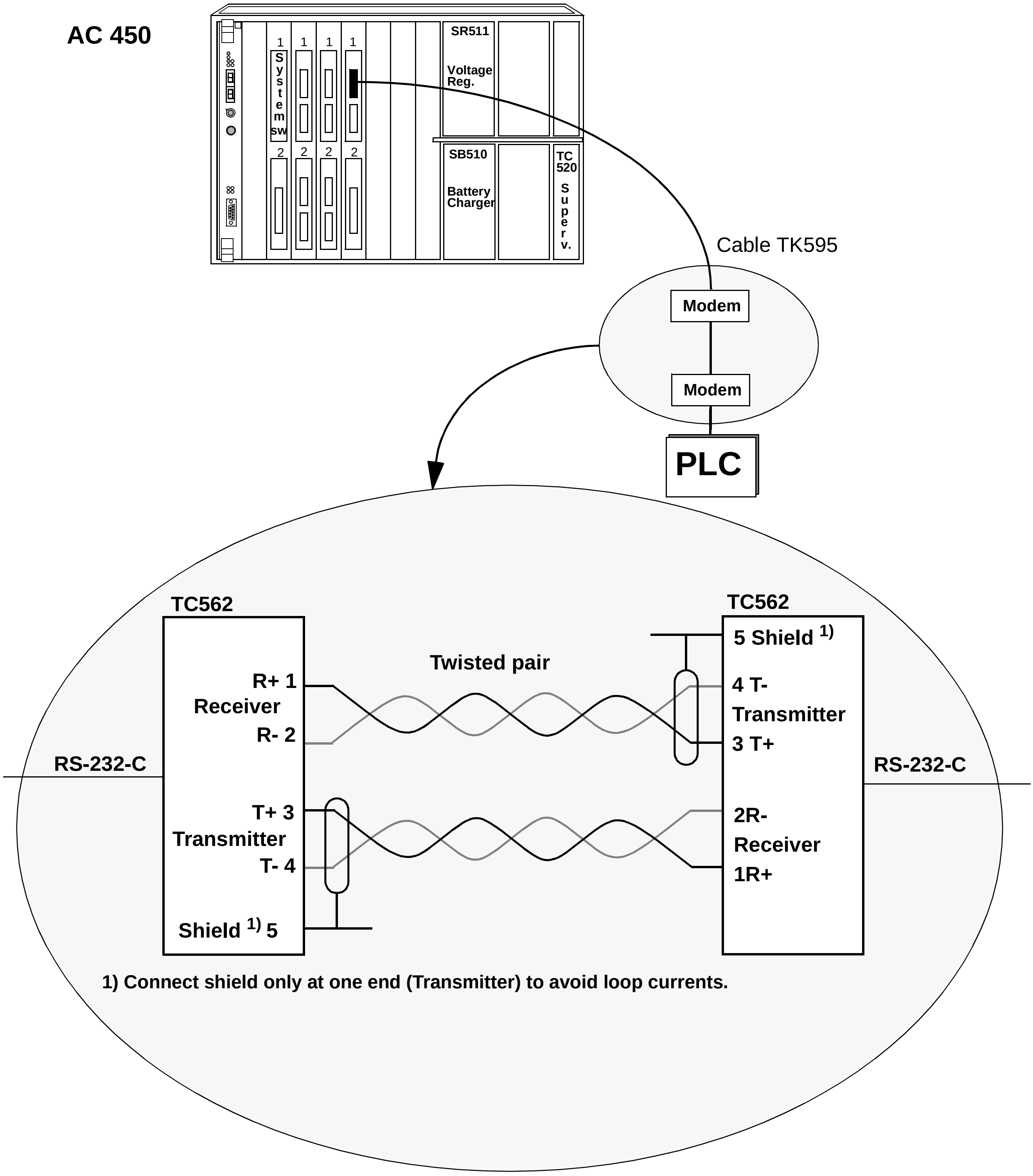


Figure 2-8. Cables and Modems in a MVI-MODBUS Full Duplex Point-to-point Connection

2.3 Shut-down Procedures

The communication is stopped when the Advant Controller 400 is in configuration mode (mode P2, indicated on the front of the main processor module).

2.4 Start-up Procedures

The Advant Controller 400 must be in runtime mode (mode P1, indicated on the front of the main processor module) to communicate on the MVI-MODBUS link. To start up the communication link, you must set up the hardware and the data base element MVIMOD, as described in Section 2.2, Installation Procedures. If the parameter NET "n" for port "n" in the MVIMOD data base element ≠ 0, the CI534V02 submodule automatically receives all the configuration data base elements. See Section 3.5, Application Procedures. The CI534V02 reports application errors if it does not receive all the required configuration data base elements.

In master mode, the CI534V02 submodule cyclically sends poll messages when nothing else is transferred on the link.

The CI534V02 submodule always restarts if the Advant Controller 400 is restarted in any way. The CI534V02 also restarts when the terminal SERVICE on the MVIMOD element is changed from 0 to 1.

Check all the system messages when you restart the CI534V02 submodule. All configuration errors are reported at start-up. Error messages with task name MVIxxx and HLxxx are translated in Section 5.2, Error Messages. Some errors are only reported once.

NOTE

If the network number or node number for any of the communication modules in the Advant Controller 400 is changed after the start-up of the node, the Advant Controller 400 must be COLD STARTED. (Connect an engineering station to the Advant Controller 400 and make a DUAP. Press ENTER on the main CPU with start-up switch in "CLEAR" position and make a LOAP.) See the manual *Source Code Handling User's Guide*.

2.5 Product Verification

When the CI534V02 submodule is correctly installed, the corresponding configuration data base elements are filled in and the controller is in operation mode, the following should be indicated:

- The green LED indicator on the front of the CI534V02 submodule must be lit.
- Data base element MVIMOD Terminals ERR and ERRTYPE = 0.

When the connection to a PLC is established, the following applies for the STATUS1 in the MVINODE data base element for the corresponding PLC:

- Link Status (bit 0) = 1
- For more information regarding the PLC Status information, see Table 3-9 and Table 3-10.

The MVICHAN element must show the following when the link is connected:

- DSR = 1
- CTS = 1 (full duplex) or toggling between 1 and 0 (half duplex)
- DCD = 1 (full duplex) or toggling between 1 and 0 (half duplex).

NOTE

Displayed values from the MVICHAN element on the engineering station are not always synchronized to the actual value change of the modem signals; short pulses may not be displayed.

Chapter 3 Configuration/Application Building

3.1 Considerations

To set up the data base element to configure the MVI-MODBUS link, define the following:

- Network structure
  - Local control network number
  - Node numbers for all stations on the MVI-MODBUS bus
  - Point to point or multidrop
  - Master and slave nodes on the bus.
- Characteristics for the line
  - Transmission speed
  - Character length, number of stop bits, parity and duplex
  - Turnaround time in the PLC (response time for a message).
- PLC Register Addresses
  - Small or large address model (register address 1-999 or 1-9999)
  - Necessary PLC Register Addresses – addresses for input registers, output registers, input status, output status, and so on.

If the CI534V02 submodule is configured as the master, you must build the MVB data base element and the PC program for the control of the data flow on the link. Before you build the MVB data base element and the PC program, consider the following:

- How are the data transferred from slave to master node?
  - Which Function codes are to be used? See Section 3.5.1, Master Functions and Section 3.6.2, MVI Data Block (MVB).
- To select the cycle time for the PC program, you must know how fast data is to be transferred.

3.2 Capacity and Performance

The maximum number of communication ports and data base elements are:

- Advant Controller 410 can have a maximum of two CI534V02 submodules with totally max four MVI-MODBUS communication ports.
- Advant Controller 450 can have a maximum of five CI534V02 submodules with totally max nine MVI-MODBUS communication ports.
- Advant Controller 410 and 450 can each have a maximum of 99 MVINODE data base elements.[1]
- The number of MVB's in an Advant Controller 410 or 450 is limited only by the amount of memory that can be set aside for the data base.

---

[1] MasterNet can handle up to 99 nodes.

- Each MVB data base element can contain up to 128 DAT elements (110 Boolean DAT elements). Each DAT element in turn can contain one Integer (2 bytes) or 32 Boolean, depending on the Function code entered and type of DAT reference.

For reasons related to performance and capacity, data that can change simultaneously should be collected into the same MVB data base element.

The tables below describe the maximal number of Boolean and Integers that can be associated to one group of register addresses.

Table 3-1. Small Address Model

Address Area	Function Code	Max No of Boolean/Integer
0001 - 0999	1, 5, 15	999
1001 - 1999	2	999
3001 - 3999	4	999
4001 - 4999	3, 6, 16	999

Table 3-2. Large Address Model

Address Area	Function Code	Max No of Boolean/Integer
00001 - 09999	1, 5, 15	9999
10001 - 19999	2	9999
30001 - 39999	4	9999
40001 - 49999	3, 6, 16	9999

To calculate the load from the MVI-MODBUS link on the main CPU in the Advant Controller 400, you must consider the following:

- Load from PC program for flow control to the MVI-MODBUS link
- Load from the MVB data base element communication.

Calculation of load from PC program and data base element communication is described in the *Advant Controller 400 Series User's Guide.*

3.2.1 Master Nodes

The CI534V02 submodule can handle a total of 55 slave nodes, divided on two ports. One single port can handle up to 32 slave nodes.

Table 3-3 shows the maximum capacity for each master port on the CI534V02. The capacity is valid for transfer of the commands with a cycle time on the PC program of 10 ms for the data flow control, see Section 3.6.6, PC Program Layout. This gives maximum performance for the link, but gives high system load. The system load must be carefully considered in every single case. The turn-around time in the slave node was eliminated. The performance measurement is made with one port in point-to-point configuration RTU mode, that is, the master communicates with one node only.

Table 3-3. Maximum Number of Read or Write Commands in Master Mode

Number of Registers	Transmission Speed (bits/s)	Max No of Commands/s
1 Boolean	9 600	20
500 Booleans	9 600	8
1000 Booleans	9 600	5
1500 Booleans	9 600	3.5
2000 Booleans	9 600	2.5
1 Integer	9 600	20
30 Integers	9 600	8
60 Integers	9 600	5
90 Integers	9 600	3.5
125 Integers	9 600	2.5
1 Boolean	19 200	25
500 Booleans	19 200	12.5
1000 Booleans	19 200	8
1500 Booleans	19 200	6
2000 Booleans	19 200	5
1 Integer	19 200	25
30 Integers	19 200	12.5
60 Integers	19 200	8
90 Integers	19 200	6.5
125 Integers	19 200	5

NOTE

The capacity depends on the load in the Advant Controller 400, the size of the data base in the Advant Controller 400, the response time in the PLC/RTU, the length of the messages and the transmission speed.

3.2.2 Slave Nodes

Each port on the CI534V02 submodule can communicate with one node (Master node).

The table below shows the maximum capacity for each port on CI534V02 in slave mode. The turn-around time in the master node was eliminated. The performance measurement is made with one port in point-to-point configuration RTU mode, that is, the master communicates with one node only.

Table 3-4. Maximum Number of Read or Write Commands in Slave Mode

Number of Registers	Transmission Speed (bits/s)	Max No of Commands/s
1 Boolean	9 600	32.5
500 Booleans	9 600	9.5
1000 Booleans	9 600	5.5
1500 Booleans	9 600	3.5
2000 Booleans	9 600	3
1 Integer	9 600	29
30 Integers	9 600	9.5
60 Integers	9 600	5.5
90 Integers	9 600	4
125 Integers	9 600	3
1 Boolean	19 200	38
500 Booleans	19 200	15
1000 Booleans	19 200	9
1500 Booleans	19 200	6.5
2000 Booleans	19 200	5
1 Integer	19 200	35
30 Integers	19 200	15.5
60 Integers	19 200	9.5
90 Integers	19 200	7
125 Integers	19 200	5

3.3 Application Start-up

To build the application data base and PC program in the Advant Controller 400, you need an engineering station. Before you can start up the communication link the following is needed:

- Dimension the data base in the Advant Controller 400 (with the command *DIMDB* from the ES). The data base must be dimensioned for the MVIMOD data base element. For each CI534V02 submodule you need one MVIMOD data base element.
- Dimension the data base in the Advant Controller 400 (with the command *DIMDB* from the ES). The data base must be dimensioned for the MVIMOD, MVICHAN, MVINODE, MVB and DAT data base element.

  For each CI534V02 submodule you need:

  - One MVIMOD data base element

  For each port you need:

  - One MVICHAN data base element
  - One MVINODE data base element per remote node on the port
  - MVB data base elements to hold data in slave mode, or to define a command and to hold data in master mode.
  - Up to 128 DAT elements for each MVB data base element.
- In master mode, the Advant Controller 400 must be dimensioned for PC programs (with the command *DIMPC* from the ES).
- Create the data base elements with the command *CRDB MVIMOD, CRDB MVICHAN, CRDB MVINODE and CRDB MVB.* Configure the data base element according to the description in Section 3.5, Application Procedures, Section 3.6.1, Data Base Elements for MVI-MODBUS Configuration and Section 3.6.2, MVI Data Block (MVB). The DAT elements are created automatically when the MVB data base element is created.
- In master mode, build a PC program as described in Section 3.6.6, PC Program Layout.
- When the application data base and PC program are ready, you can start up the communication link as described in Section 2.2, Installation Procedures.

3.4 Tutorial

The indications **(A), (B), (C)**, and so on, in the text below refer to identical indications in the figures describing the data base and PC program in this example.

This example describes the necessary application programming and data base in the Advant Controller 450 master for writing 24 Integer DATs from the master to two slave nodes and reading 24 Integer DATs from the same two slaves. The same range of MODBUS Register Addresses is used for both the slave nodes. The register address 4001 **(A)** is used for the Write Command (Function code 16) **(B)** and 3001 **(C)** is used for the Read Command (Function code 4) **(D)**. In this example, one of the slave nodes is an Advant Controller 410. The data base for the Advant Controller 410 slave node is also described.

The configuration of the link is made for multidrop connection, **MODBUS RTU (E)** and **small address model (F)**.

Data in the Advant Controller 450 Master Node: (G)

- CI534V02 submodule number = 7 (MVIMOD Record number = 1) **(H)**
- Reference (Name of) to the MVICHAN data base element corresponding to the 1st channel **(I)**
- Node number = 10 **(J)**
- Network number = 4 **(K)** MVIMOD in POSITION = 4 and SUBPOSITION = 2 **(L)**
- Only port 1 used.

Data in the Advant Controller 410 Slave Node: (M)

- CI534V02 submodule number = 7 (MVIMOD Record number = 1) **(N)**
- Node number = 15 **(O)**
- Network number = 4 **(P)**
- MVIMOD module in POSITION = 1 and SUBPOSITION =4 **(Q)**
- Only port 1 used.

Data in the PLC Slave Node: (R)

- Node number = 16 **(S)**
- Network number = 4**.**

Data for the Modems:

- Transmission speed 9600 bits/s, full duplex **(U).**

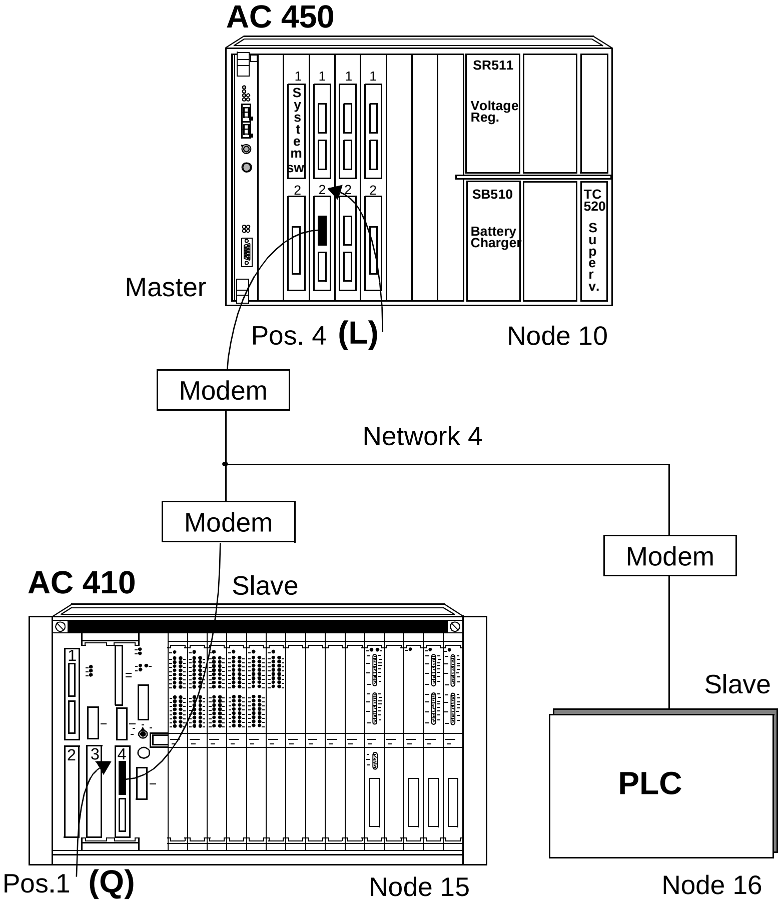


Figure 3-1. Configuration for the Example

3.4.1 Application in Advant Controller 450 Master Node

3.4.1.1 Data Base in Advant Controller 450 Master Node

- Three **Configuration data base elements** must be built in the application data base:
  - MVIMOD data base element
  - MVICHAN data base element
  - MVINODE data base element.
- One **MVB data base element** is used to **write data** to the slave node.
- One **MVB data base element** is used to **read data** from the slave node.

Definition for the CI534V02 Submodule

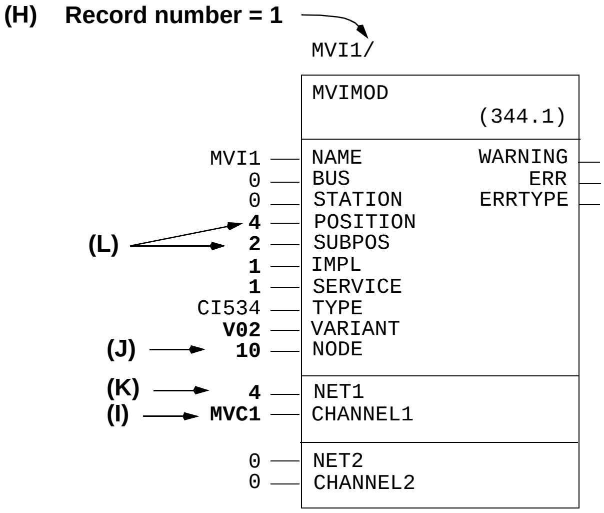


Figure 3-2. MVIMOD Data Base Element for Master Node

Configuration of the Communication Line

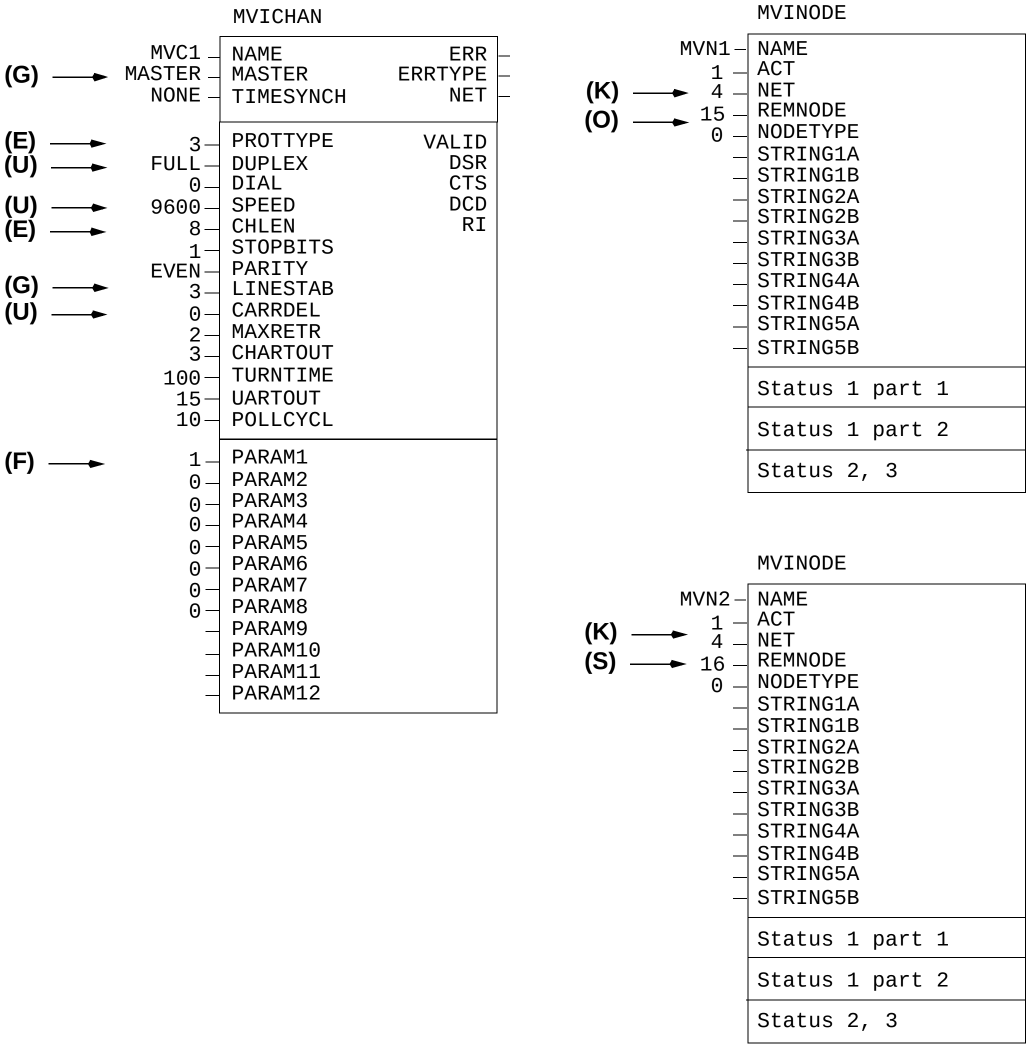


Figure 3-3. Line Characteristics, Network Configuration and Status in Master Node

Configuration of Command MVB

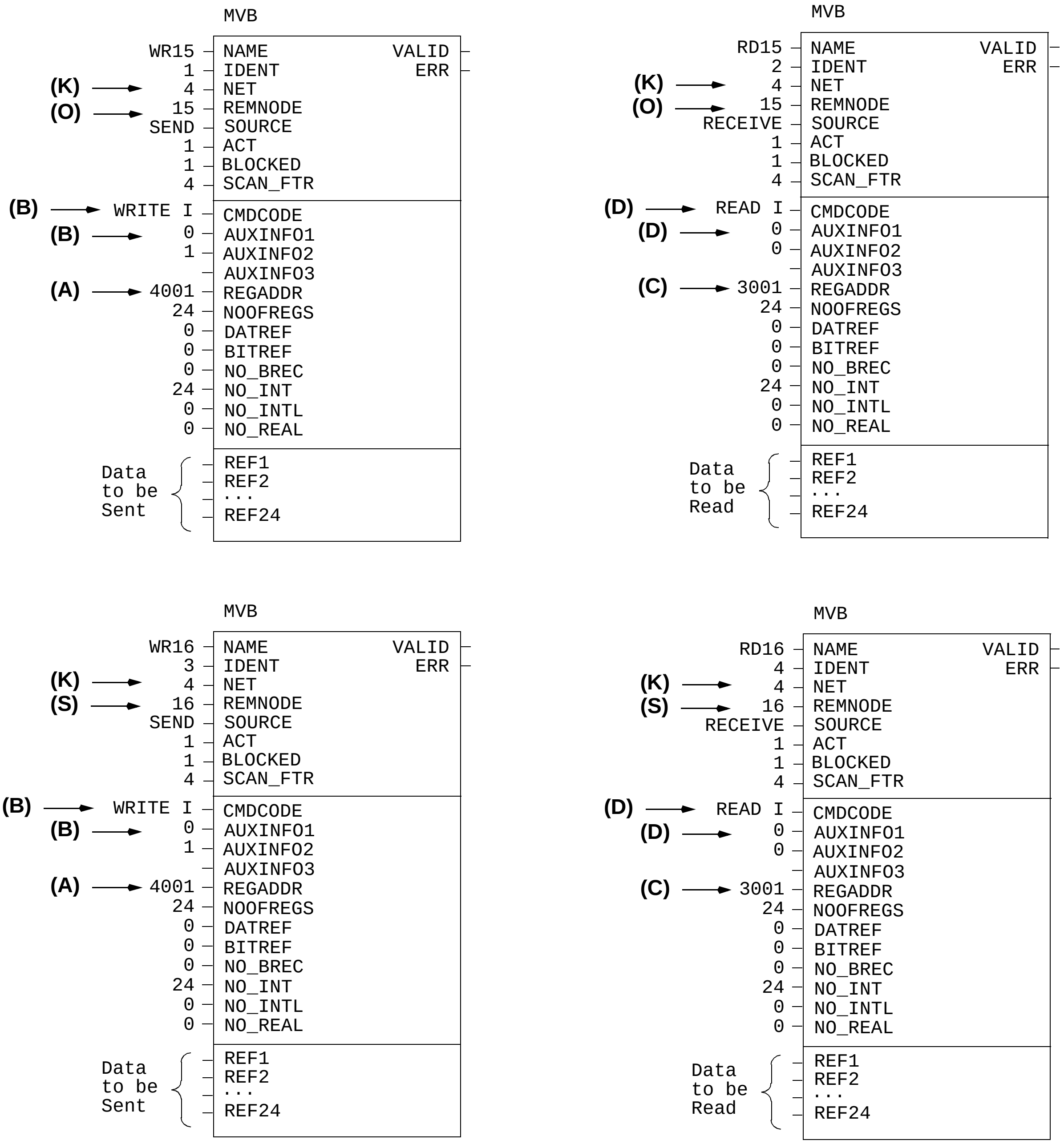


Figure 3-4. Command MVB's in Master Node

For each slave node, one sending MVB data base element is used for the Write Command and one receiving MVB data base element is used for the Read Command.The sending MVB data base element contains the data corresponding to MODBUS register address 4001 - 4024 (start address 4001 is connected to REF1 of the MVB data base element). The receiving MVB data base element (for the Read Command) contains the data corresponding to MODBUS register address 3001 - 3024 (start address 3001 is connected to REF1 of the data base element).
The send and receive MVB data base elements have NET and NODE defined as the network and node number to the slave node.

3.4.1.2 PC Program in Advant Controller 450 Master Node

The PC program is designed to send one Write Command and one Read Command each 200 msec. The Link status (MVN1:VALUE) and Ready for Message (MVN1:VALUE6) are fetched from the MVINODE data base element for the PLC in question.

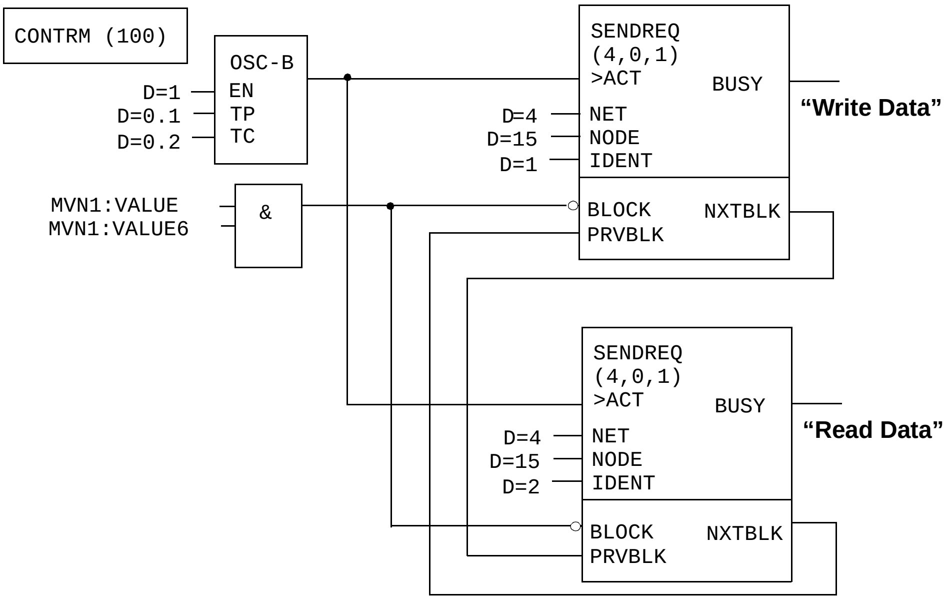


Figure 3-5. PC Program for Sending Data to Slave Node 15

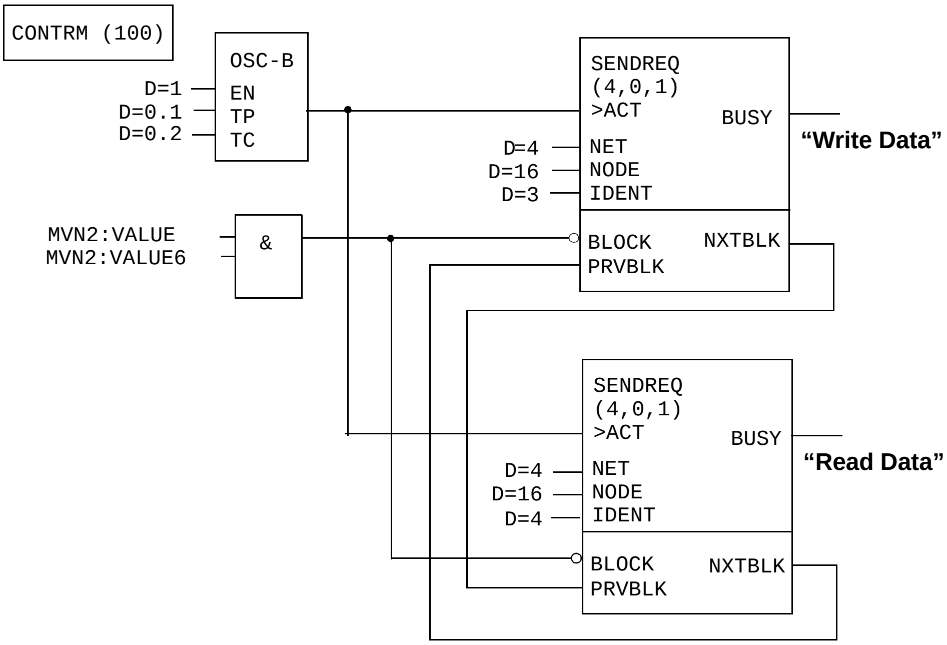


Figure 3-6. PC Program for Sending Data to Slave Node 16

3.4.2 Application in Advant Controller 410 Slave Node

3.4.2.1 Data Base in Advant Controller 410 Slave Node:

- Three **Configuration data base elements** must be built in the application data base
  - MVIMOD data base element
  - MVICHAN data base element
  - MVINODE data base element.
- One **MVB data base element** is used to hold data written from the master node.
- One **MVB data base elements** is used to hold data read from the master node.

Definition for the CI534V02 Submodule

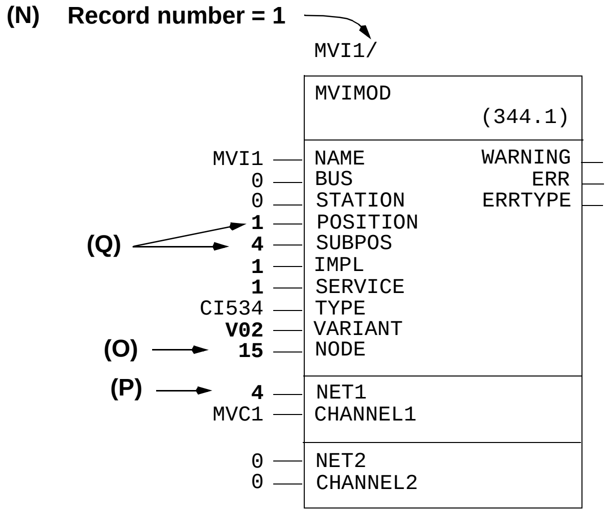


Figure 3-7. MVIMOD Data Base Element for Slave Node

Configuration of the Communication Line

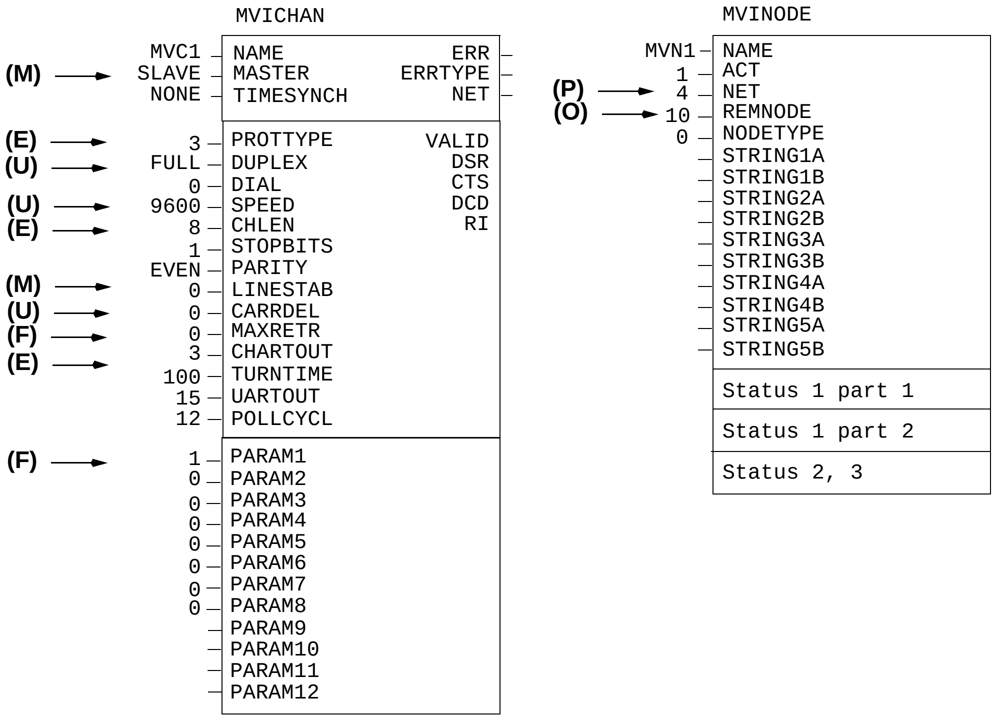


Figure 3-8. Line Characteristics, Network Configuration and PLC Status in Slave Node

Definition of Register Addresses and Data Transfer

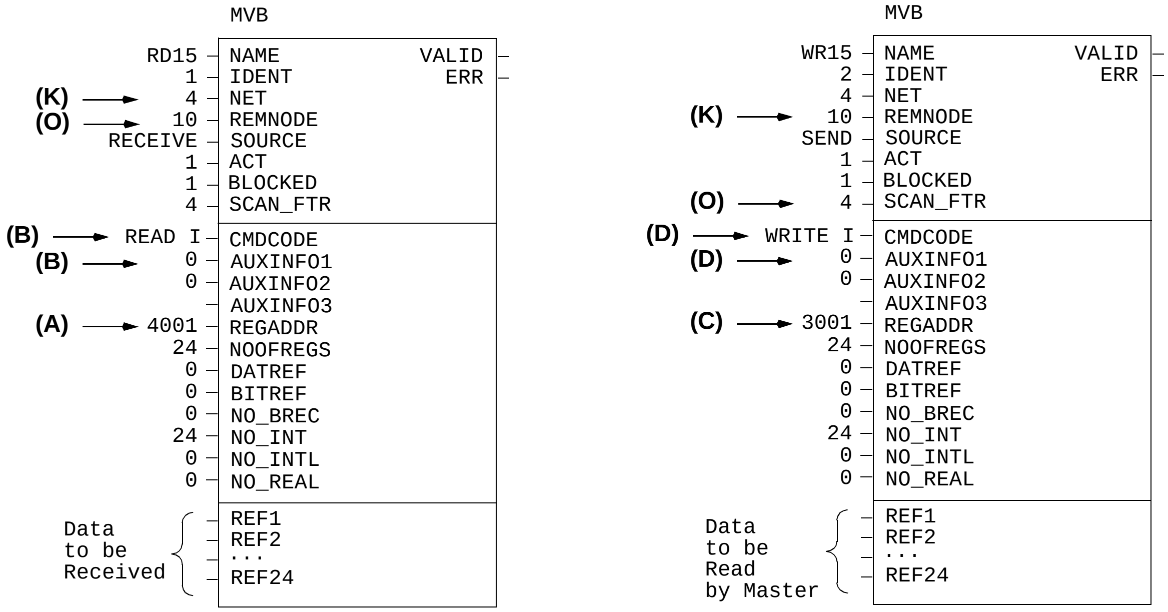


Figure 3-9. MVB Data Base Elements for Data Transfer in Slave Node

3.4.2.2 PC Program in Advant Controller 410 Slave Node

No **PC program** is necessary in the slave node.

3.5 Application Procedures

This is a summary of the steps needed to build the application data base and PC program for the MVI-MODBUS communication in the Advant Controller 400. See Section 3.6, Configuration of MVI-MODBUS Application Data Base and PC program for a detailed description of the MVI-MODBUS application.

1. Answer the questions described in Section 3.1, Considerations:
   - Network structure
   - Line Characteristics
   - Function codes to be used for the data transfer
   - Register Addresses to be used
   - Cycle time for PC program.
2. Build the Configuration data base elements:
   - MVIMOD data base element (always necessary)
   - MVICHAN data base element (always necessary)
   - MVINODE data base elements (always necessary).

3. Build MVB data base elements for command and data transfer in master mode:
    - Read Command data base element
    - Write Command data base element.
4. Build MVB data base elements for data transfer in slave mode:
    - Sending MVB data base element
    - Receiving MVB data base element.
5. Build PC program for flow control:
    - The PC program is only necessary in master mode.

PC Program

Use the PC program to control the MVB data base element if CI534V02 is used in master mode. The PC program is not necessary in slave mode.

The PC program controls the data flow through the asynchronous port by means of the PC element SENDREQ and status information received from the CI534V02 submodule. The SENDREQ element activates the MVB data base element. All SENDREQ PC elements used for MVB data base elements to the same PLC must be included in the same control module (CONTRM). The PC program is described in Section 3.6.6, PC Program Layout.

Data Base

The necessary data base input for the CI534V02 submodule is defined with configuration data base elements and data transfer data base elements.

The data base is divided into two parts: Configuration elements (MVIMOD, MVICHAN and MVINODE) and data transfer data base elements (MVB).

- **Configuration data base elements (MVIMOD, MVICHAN and MVINODE)**

  MVIMOD data base element is used to set up the two ports on the CI534V02 submodule, see Section 2.2, Installation Procedures

  MVICHAN (defines transmission speed, time-out times, etc.), **MVINODE** represents a node on the MODBUS link (one element for each node), and holds the status information for the node.

- **Data transfer data base elements MVB**

  Specifies commands and holds data to control slaves when the CI534V02 is used in master mode. Holds data when the CI534V02 submodule is used in slave mode.

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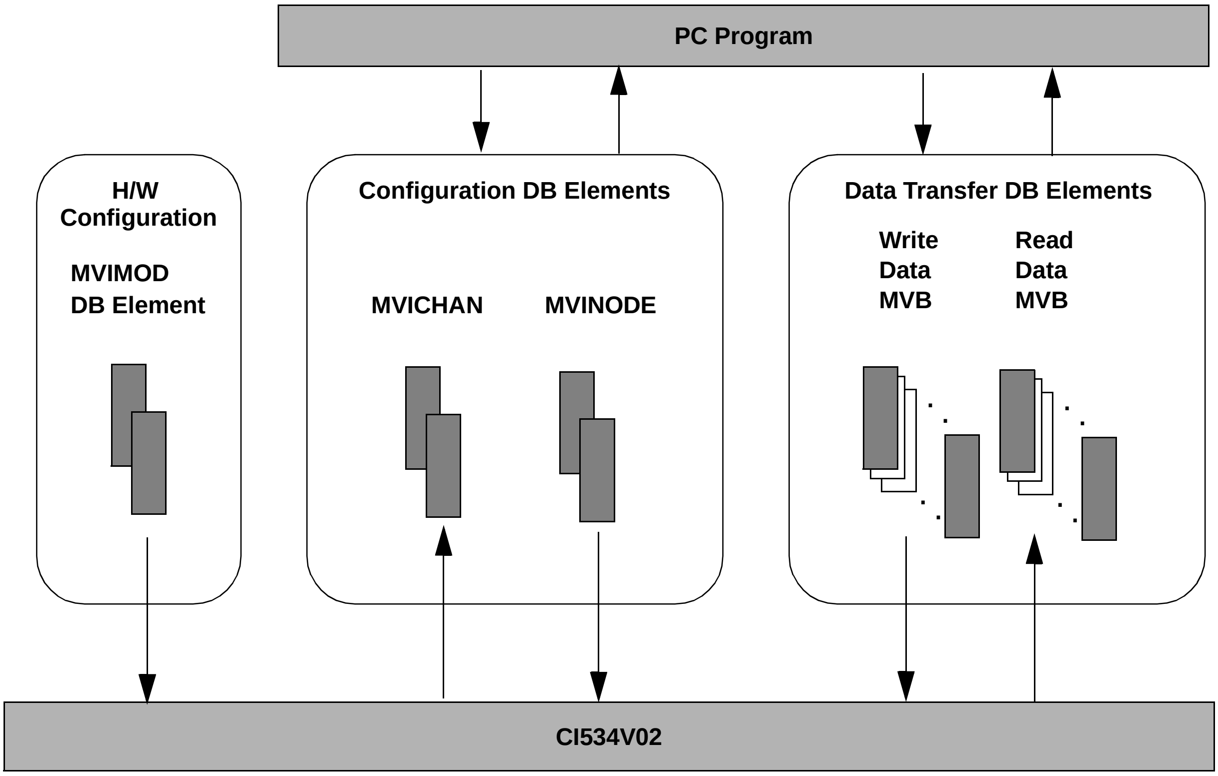


Figure 3-10. Overview of the Application for MVI-MODBUS

3.5.1 Master Functions

The MODBUS functions mentioned below can be defined/controlled at the **application** level in master mode:

- **Read output status (Function code 1)**

  Read Command data base element CMDCODE = READ B, AUXINFO1 = 1, AUXINFO2 = 0
- **Read input status (Function code 2)**

  Read Command data base element CMDCODE = READ B, AUXINFO1 = 0, AUXINFO2 = 0
- **Read output registers (Function code 3)**

  Read Command data base element CMDCODE = READ I, AUXINFO1 = 1, AUXINFO2 = 0
- **Read input registers (Function code 4)**

  Read Command data base element CMDCODE = READ I, AUXINFO1 = 0, AUXINFO2 = 0

- **Force single coil (Function code 5)**

  Write Command data base element CMDCODE = WRITE B, AUXINFO1 =0, AUXINFO2 = 0

- **Preset single register (Function code 6)**

  Write Command data base element CMDCODE = WRITE I, AUXINFO1 =0, AUXINFO2 = 0

- **Read exception status (Function code 7)**

  Read Command data base element CMDCODE = READ I, AUXINFO1 =0, AUXINFO2 = 1

- **Force multiple coils (Function code 15)**

  Write Command data base element CMDCODE = WRITE B, AUXINFO1 =0, AUXINFO2 = 1

- **Preset multiple registers (Function code 16)**

  Write Command data base element CMDCODE =WRITE I, AUXINFO1 =0, AUXINFO2 = 1.

Broadcast is not handled by the master.

See Section 3.6.3.1, Read Command for a description of the Read MVB data base element and Section 3.6.3.2, Write Command for a description of the Write MVB data base element.

3.5.2 Slave Functions

It is not necessary to define any functions at application level in slave mode. Only the Configuration data base element described in Section 3.6.1, Data Base Elements for MVI-MODBUS Configuration and the MVB data base elements for transmission of data have to be defined. Read exception status (Function 7) is not implemented in slave mode. If function code 7 is received, the CI534V02 slave replies with the exception response “Illegal function code” (H'87).

3.6 Configuration of MVI-MODBUS Application Data Base and PC program

3.6.1 Data Base Elements for MVI-MODBUS Configuration

This section describes the Configuration data base elements used to configure the CI534V02 submodule. These data base elements contain setup information for the hardware and software of the CI534V02 submodule. Status information is also received from CI534V02. The status information can be used by the application program.

3.6.1.1 MVICHAN Data Base Elements

The line characteristics of CI534V02 are specified in one MVICHAN data base element for each communication channel. This means that one CI534V02 is fully configured by one MVIMOD data base element and two MVICHAN data base elements.

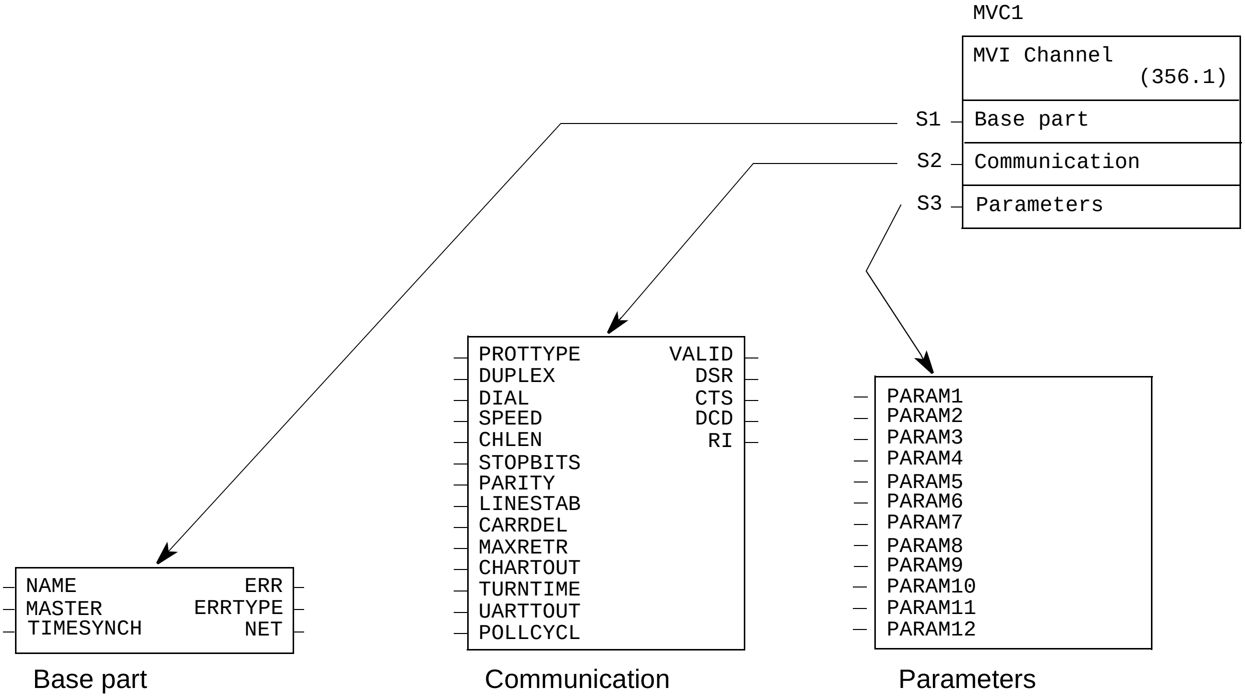


Figure 3-11. Overview of MVICHAN Data Base Element

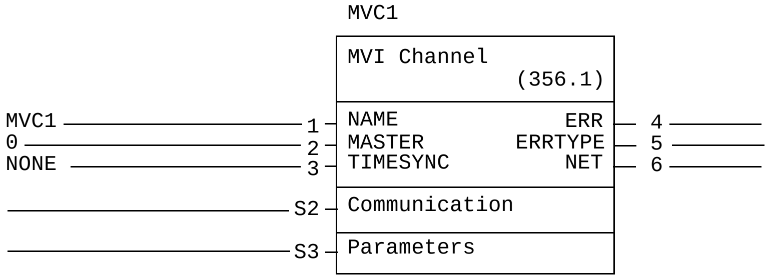


Figure 3-12. Data Base Element MVICHAN Base Part for MVI-MODBUS

Table 3-5. Terminal Description for MVICHAN, Base Part

Terminal No.	Terminal Name	Value entered by	Recommended Value	PC Connection Data Type	Description	Remarks
1	NAME	User	MVCx	–	Unique element **NAME**.	Maximum 20 characters
2	MASTER	User	0	B(r/w)	MVI channel in: 0 = slave mode 1 = **MASTER** mode	–
3	TIMESYNC	User	NONE	–	MVI **TIME SYNC**hronization is not applicable for MODBUS	–
4	ERR	System	0	B(r)	**ERR**or.	–
5	ERRTYPE	System	0	IL(r)	**ERR**or **TYPE**.	–
6	NET	System	0	I(r)	**NET**work number of MVI channel.	–

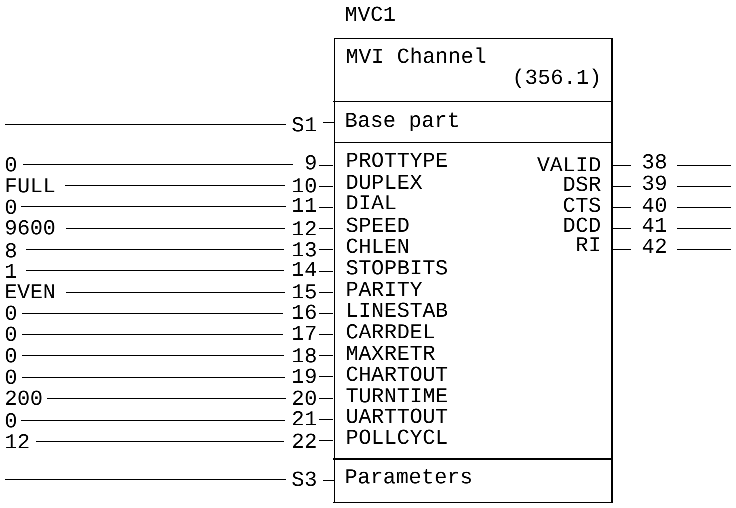


Figure 3-13. Data Base Element MVICHAN Communication for MVI-MODBUS

Table 3-6. Terminal Description for MVICHAN Communication Part

Terminal No.	Terminal Name	Value entered by	Recommended Value	PC Connection Data Type	Description	Remarks
9	PROTTYPE	User	3, 4	I(r/w)	**PROT**ocol **TYPE**. 3 = MODBUS RTU (Binary mode) 4 = MODBUS ASCII	0..255
10	DUPLEX	User	FULL	I(r/w)	**DUPLEX** mode, concerns modem signals between MVI channel and modem. Values: FULL, HALF, HALFNODCD (DCD IGNORED)	–
11	DIAL	User	0	B(r/w)	**DIAL**ing. 0 = disabled (used for private line) 1 = enabled (used for dial line) **Not** applicable for MODBUS	–
12	SPEED	User	9600	I(r/w)	Transmission **SPEED** of communication in bits/second. Values: 150, 300, 600, 1200, 2400, 4800, 9600, 19200	–
13	CHLEN	User	7 ASCII mode 8 RTU mode (Binary)	I(r/w)	**CH**aracter **LEN**gth in bits. Values: 7, 8	–
14	STOPBITS	User	1	I(r/w)	**STOP BITS**. Values: 0.5, 1, 1.5, 2	–
15	PARITY	User	EVEN	I(r/w)	**PARITY**. Values: NONE, ODD, EVEN	–
16	LINESTAB	User	3 for RTU mode 1 for ASCII mode, half duplex 0 for ASCII mode, full duplex	I(r/w)	**LINE STAB**ilization time in number of character transmission times. Time to allow the carrier wave to stabilize before transmission of the first character. Restrictions for half duplex: "(own) LINESTAB time ≥ (opposite side) CARRDEL time". See Figure 3-15.	0..15
17	CARRDEL	User	0 for full duplex 1 for half duplex	I(r/w)	**CARR**ier **DEL**ay time in number of character transmission times. Time to wait after the transmission of the last character before deactivating RTS. This delay is used to avoid destruction of the last character in the message, due to lost carrier. See Figure 3-15.	0..15
18	MAXRETR	User	2 for master 0 for slave	I(r/w)	**MAX**imum number of **RETR**ansmissions before line is considered broken.	0..20

Table 3-6. Terminal Description for MVICHAN Communication Part (Continued)

Terminal No.	Terminal Name	Value entered by	Recommended Value	PC Connection Data Type	Description	Remarks
19	CHARTOUT	User	3	I(r/w)	**CHAR**acter **T**ime-**OUT** time in number of character transmission times. Used by receive routine to detect idle receive line. 0: no check for time-out is made.	0..15
20	TURNTIME	User	600	IL(r/w)	**TURN** around **TIME** in milliseconds. Time to wait as from the last character in the command until the first character in the reply, i.e. the time-out time.	0..20000
21	UARTTOUT	User	1 for full duplex 2 for half duplex	I(r/w)	**UART** transmission **T**ime-**OUT** in number of character transmission times. If half duplex is used, a check of DCD will be made by the send routine before activating RTS. If DCD is activated the send routine will wait for DCD to be deactivated up to this time before aborting the transmission.	0..15
22	POLLCYCL	User	96000/SPEED for master 1.2∗96000/SPEED for slave	I(r/w)	Maximum time between two **POLL**ing **CYCL**es in seconds.	0..255
38	VALID	System	–	B(r)	Signals DSR etc. is **VALID**	–
39	DSR	System	–	B(r)	Modem signal **D**ata **S**et **R**eady.	–
40	CTS	System	–	B(r)	Modem signal **C**lear **T**o **S**end	–
41	DCD	System	–	B(r)	**D**ata **C**arrier **D**efect	–
42	RI	System	–	B(r)	Modem signal **R**ing **I**ndicator.	–

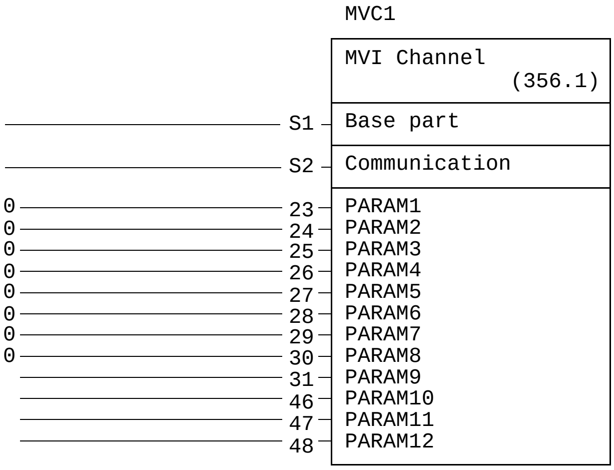


Figure 3-14. Data Base Element MVICHAN Parameters for MVI-MODBUS

Table 3-7. Terminal Description for MVICHAN, Parameter Part

Terminal No.	Terminal Name	Value entered by	Recommended Value	PC Connection Data Type	Description	Remarks
23	PARAM1	User	0 = Large 1 = Small	IL(r/w)	Defines the address model. The addresses 0XXXX, 1XXXX, 3XXXX and 4XXXX correspond to the large model (XXXX=1-9999). The addresses 0XXX, 1XXX, 2XXX, 4XXX correspond to the small model (XXX=1-999)	$0..2^{31}$
24 . . 30	PARAM2 . . PARAM8	User	0	IL(r/w)	**Not** used for MODBUS.	–
31	PARAM9	User	–	A20(r/w)	Protocol dependent string parameter. **Not** used for MODBUS	Maximum 20 characters
46	PARAM10	User	–	A20(r/w)	Protocol dependent string parameter. **Not** used for MODBUS	Maximum 20 characters
47	PARAM11	User	–	A20(r/w)	Protocol dependent string parameter. **Not** used for MODBUS	Maximum 20 characters
48	PARAM12	User	–	A20(r/w)	Protocol dependent string parameter. **Not** used for MODBUS	Maximum 20 characters

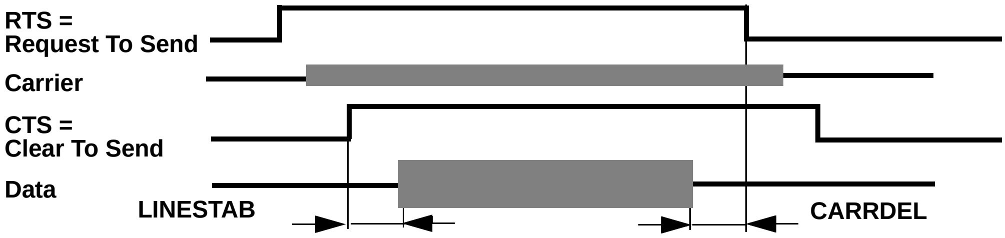


Figure 3-15. LINESTAB and CARRDEL in Half Duplex Mode

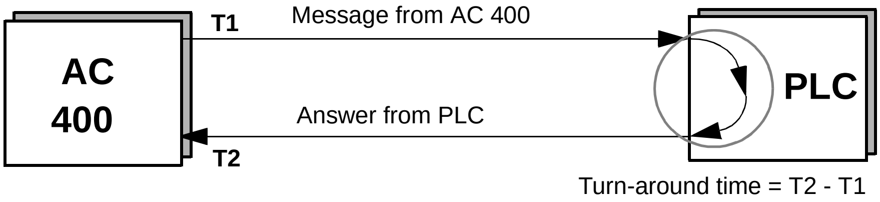


Figure 3-16. Turn-around Time

3.6.1.2 MVINODE Data Base Element

Every node on a MVI local control network is represented by a data base element of type MVINODE. The element specifies:

- In master mode: Each slave node on the bus is represented by one data base element.
- In slave mode: Only one data base element representing the slave node view of the master node is needed.

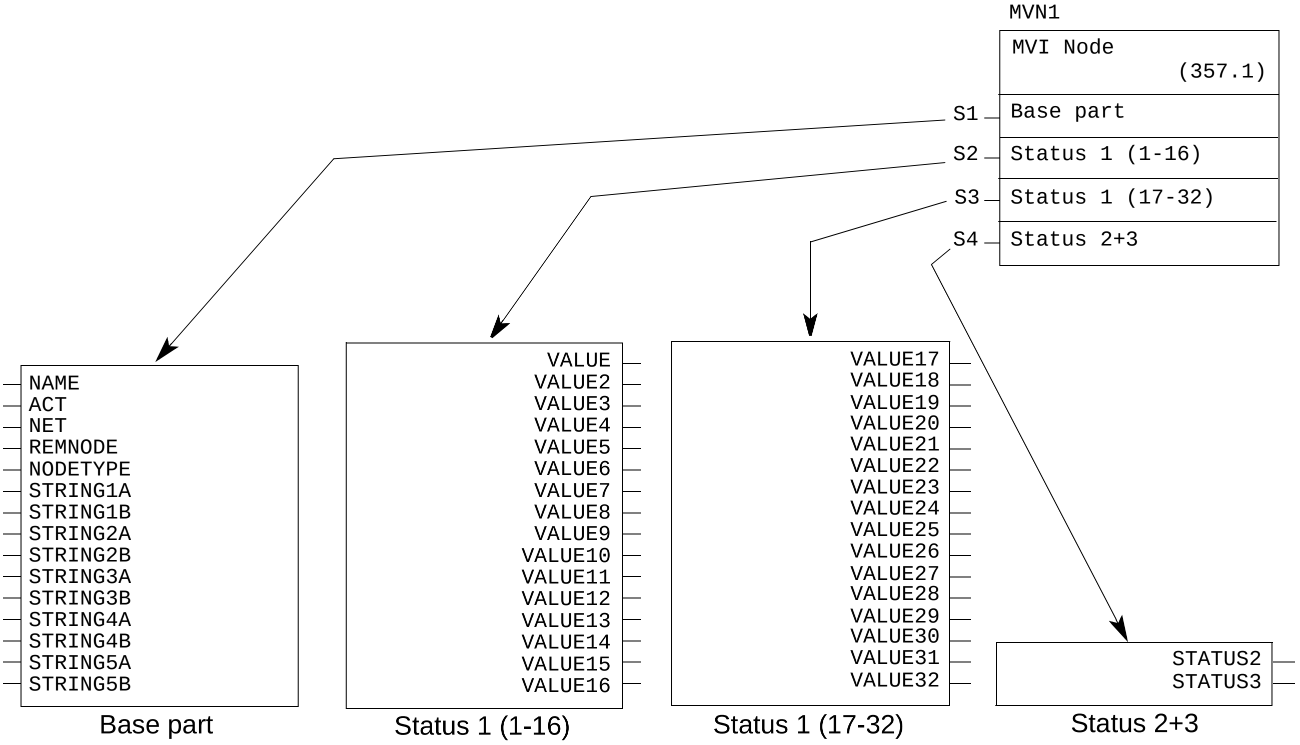


Figure 3-17. Overview of MVINODE Data Base Element

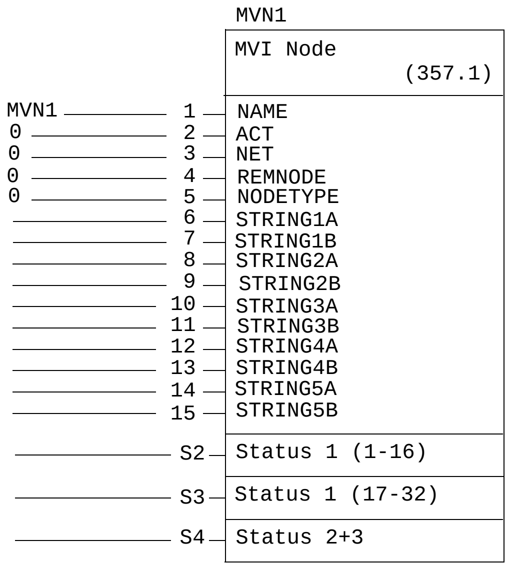


Figure 3-18. Data Base Element MVINODE Base Part for MVI-MODBUS

Table 3-8. Terminal Description for MVINODE Base Part

Terminal No.	Terminal Name	Value entered by	Recommended Value	PC Connection Data Type	Description	Remarks
1	NAME	User	MVNx	–	Unique module **NAME**.	Maximum 20 characters.
2	ACT	User	1	B(r/w)	0=the element is spare 1=the element is **ACT**ive	–
3	NET	User	1	–	**NET**work number of remote node.	0..9
4	REMNODE	User	1	I(r/w)	**REM**ote **NODE** number.	0..99
5	NODETYPE	User	0	I(r/w)	Remote **NODETYPE**.	0..32767
6	STRING1A	User	–	A20(r/w)	**STRING 1A**. **Not** used in MODBUS.	Maximum 20 characters.
7 : : 15	STRING1B : : STRING5B	User : : User	– : : –	A20(r/w) : : A20(r/w)	**STRING 1B**. **Not** used in MODBUS. : : **STRING 5B**. **Not** used in MODBUS.	Maximum 20 characters. : : Maximum 20 characters.

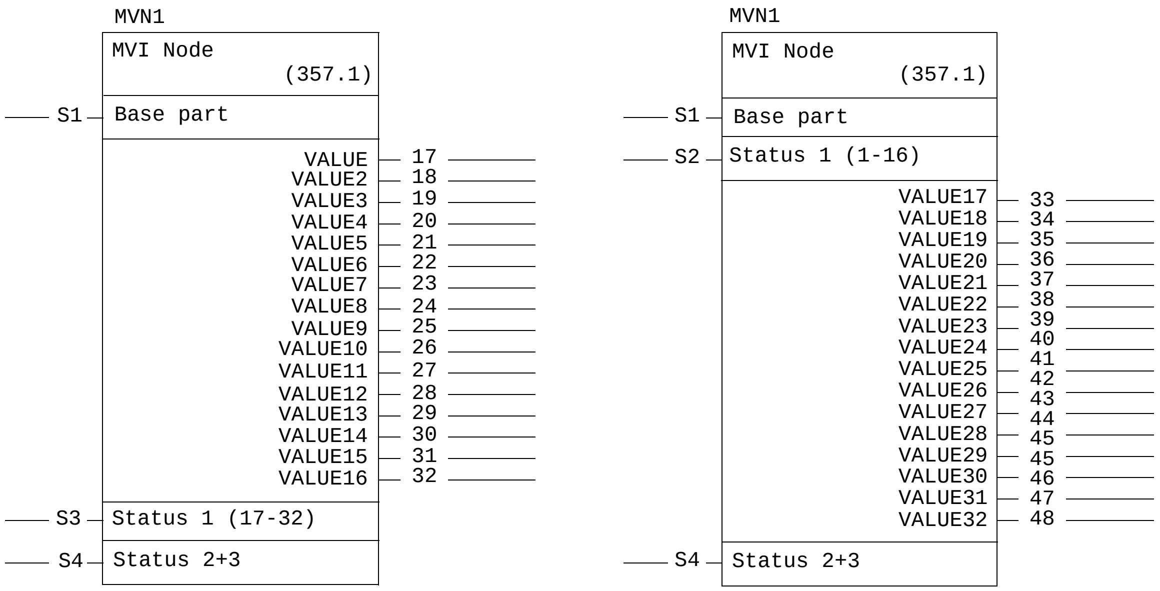


Figure 3-19. Status 1 (1-16) / Status 1 (17-32)

Status1

Contains information required for flow control, among other things, see Table 3-9, below.

Table 3-9. Status1

Terminal No.	Terminal Name	Value entered by	Recommended Value	PC Connection Data Type	Description	Remarks
17	VALUE	System	-	B(r)	**Link status** The corresponding PLC reachable, see Figure 3-30 Set to “1” when the remote node is reachable. Set to “0” when contact with remote node is lost (including restart of CI534V02). The master considers the contact lost after maximum number of retransmissions without an answer. The slave node considers the contact lost when the times between messages from the master exceed the poll cycle time.	Slave and master
18	VALUE2	System	-	B(r)	**Not** used in MODBUS	

Table 3-9. Status1 (Continued)

Terminal No.	Terminal Name	Value entered by	Recommended Value	PC Connection Data Type	Description	Remarks
19	VALUE3	System	-	B(r)	**Not** used in MODBUS	
20	VALUE4	System	-	B(r)	**Illegal register address received** Set to "1" when illegal register address is received from an AMPL application command. Set to "0" when receiving valid register address.	Master
21	VALUE5	System	-	B(r)	**Illegal Function code received** Set to "1" when illegal Function code is received from an AMPL application command. Set to "0" when receiving valid function code	Master
22	VALUE6	System	-	B(r)	**Ready for Message** Set to "1" when no command is pending, from the application to the PLC. Set to "0" when a command is pending, from the application to the PLC. Used by the PC program for flow control, see Figure 3-30.	Master
23	VALUE7	System	-	B(r)	**Illegal Function code reported from PLC** (MODBUS Exception Response Code 1). The Function code can not be handled by the PLC. Set to "1" when received. Set to "0" when CI534V02 is restarted.	Master
24	VALUE8	System	-	B(r)	**Illegal data address reported from PLC** (MODBUS Exception Response Code 2). The address referenced in the data field is not an allowed address in the slave. Set to "1" when Response Code 2 is received. Set to "0" when CI534V02 is restarted.	Master

Table 3-9. Status1 (Continued)

Terminal No.	Terminal Name	Value entered by	Recommended Value	PC Connection Data Type	Description	Remarks
25	VALUE9	System	-	B(r)	**Illegal data value reported from PLC** (MODBUS Exception Response Code 3). The address referenced in the data field is not an allowed address in the slave. Set to “1” when Response Code 3 is received. Set to “0” when CI534V02 is restarted.	Master
26	VALUE10	System	-	B(r)	**Failure in associated device reported from PLC** (MODBUS Exception Response Code 4). Set to “1” when Response Code 4 is received. Set to “0” when CI534V02 is restarted.	Master
27	VALUE11	System	-	B(r)	**Memory parity error reported from PLC** (MODBUS Exception Response Code 8). Set to “1” when Response Code 8 is received. Set to “0” when CI534V02 is restarted.	Master
28	VALUE12	System	-	B(r)	**Not** used in MODBUS	
29	VALUE13	System	-	B(r)	**Not** used in MODBUS	
30	VALUE14	System	-	B(r)	**Not** used in MODBUS	
31	VALUE15	System	-	B(r)	**Not** used in MODBUS	
32	VALUE16	System	-	B(r)	**Not** used in MODBUS	
33	VALUE17	System	-	B(r)	**Response data from Function code 7 (Exception status). Bit 0** Set to “0”” at restart of CI534V02.	Master (See **Note** below.)
34	VALUE18	System	-	B(r)	**Response data from Function code 7 (Exception status). Bit 1** Set to “0” at restart of CI534V02.	Master (See **Note** below.)
35	VALUE19	System	-	B(r)	**Response data from Function code 7 (Exception status). Bit 2** Set to “0” at restart of CI534V02.	Master (See **Note** below.)
36	VALUE20	System	-	B(r)	**Response data from Function code 7 (Exception status). Bit 3** Set to “0” at restart of CI534V02.	Master (See **Note** below.)

Table 3-9. Status1 (Continued)

Terminal No.	Terminal Name	Value entered by	Recommended Value	PC Connection Data Type	Description	Remarks
37	VALUE21	System	-	B(r)	**Response data from Function code 7 (Exception status). Bit 4** Set to "0" at restart of CI534V02.	Master (See **Note** below.)
38	VALUE22	System	-	B(r)	**Response data from Function code 7 (Exception status). Bit 5** Set to "0" at restart of CI534V02.	Master (See **Note** below.)
39	VALUE23	System	-	B(r)	**Response data from Function code 7 (Exception status). Bit 6** Set to "0" at restart of CI534V02.	Master (See **Note** below.)
40	VALUE24	System	-	B(r)	**Response data from Function code 7 (Exception status). Bit 7** Set to "0" at restart of CI534V02.	Master (See **Note** below.)
41	VALUE25	System	-	B(r)	**Not** used in MODBUS	
42	VALUE26	System	-	B(r)	**Not** used in MODBUS	
43	VALUE27	System	-	B(r)	**Not** used in MODBUS	
44	VALUE28	System	-	B(r)	**Not** used in MODBUS	
45	VALUE29	System	-	B(r)	**Not** used in MODBUS	
46	VALUE30	System	-	B(r)	**Not** used in MODBUS	
47	VALUE31	System	-	B(r)	**Not** used in MODBUS	
48	VALUE32	System	-	B(r)	**Not** used in MODBUS	

NOTE

Status 1 VALUE17 -24 describe the response for Function code 7, Read Exception status. The response is hardware specific.
For further information, refer to *MODBUS Protocol Reference Guide.*

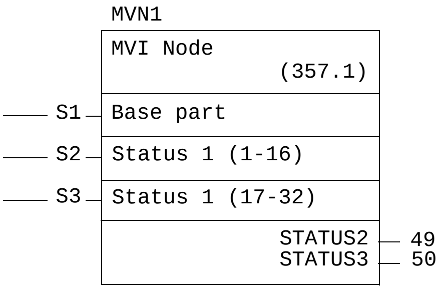


Figure 3-20. Status 2+3

Status2 and Status3 (Integer Long)

If the CI534V02 submodule receives an illegal address or function code, either from an AMPL configuration program or from a PLC, Status2 and Status3 show additional information. See Table 3-10.

Table 3-10. Status2 + Status3 (Integer Long)

Terminal No.	Terminal Name	Value entered by	Recommended Value	PC Connection Data Type	Description	Remarks
49	Status 2	System	-	IL(r/w)	If Status1 VALUE4 = 1 or VALUE8 = 1 that is, an address error, the Status2 holds the address that caused the error. Status2 is reset at restart of the CI534V02	$0 - 2^{31}$
50	Status 3	System	-	IL(r/w)	If Status 1 VALUE5 = 1 or VALUE7 = 1 that is an illegal Function Code, the Status 3 holds the Function code that caused the error. Status 3 is reset at restart of the CI534V02.	$0 - 2^{31}$

3.6.2 MVI Data Block (MVB)

The MVI Data Block element specifies either data transmission to other MVI nodes or commands sent locally to the protocol handler on the MVI submodule. When used for data transmission, the MVB data base element on the sending side, both specifies a command and holds the data for transmission. On the receiving side, the MVB data base element just holds the data.

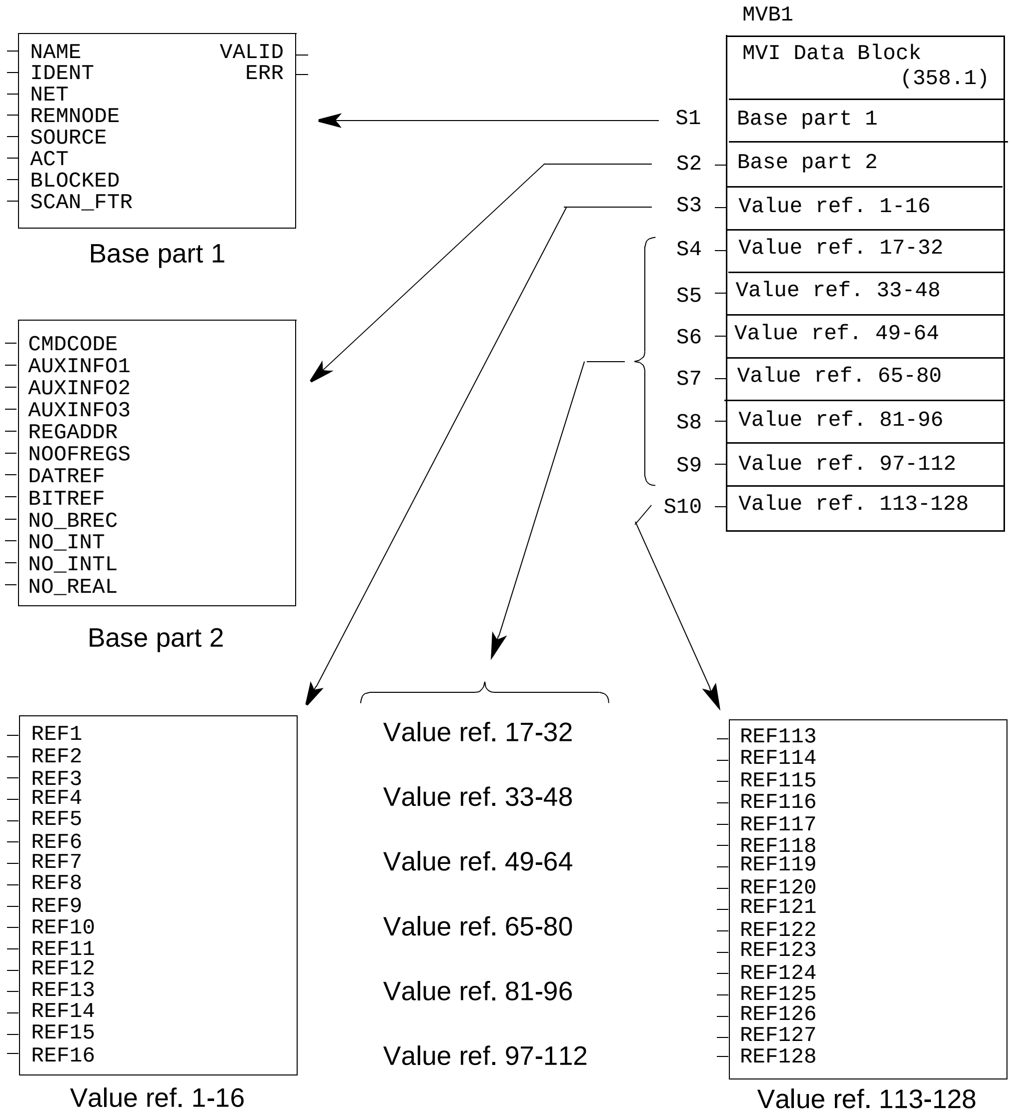


Figure 3-21. Overview of MVB Data Base Element

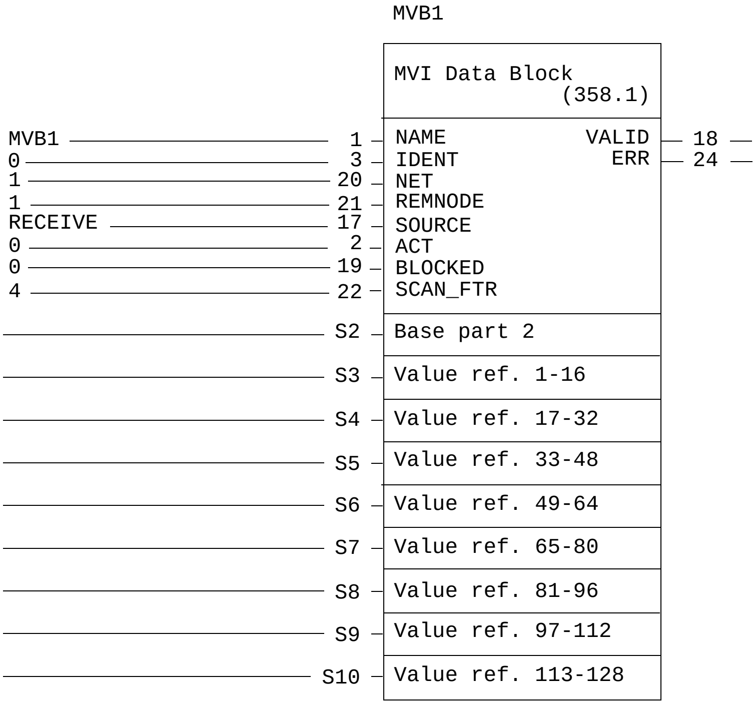


Figure 3-22. MVB Base Part 1

Table 3-11. Terminal Description of MVB for Base Part 1

Terminal No.	Terminal Name	Value entered by	Recommended Value	PC Connection Data Type	Description	Remarks
1	NAME	User	MVBx	–	Unique module **NAME**.	Maximum 20 characters.
3	IDENT	User	-	–	**IDENT**ity. A number which must be unique for a combination of NET and REMNODE.	1..255
20	NET	User	1	–	**NET**work number. Defined at the MVIMOD data base element for the CI534V02.	1..9
21	REMNODE	User	1	–	**REM**ote **NODE** number. RTU number (node) of the receiving RTU. REMNODE must be the same as in the corresponding MVINODE.	1..99

Table 3-11. Terminal Description of MVB for Base Part 1 (Continued)

Terminal No.	Terminal Name	Value entered by	Recommended Value	PC Connection Data Type	Description	Remarks
17	SOURCE	User	RECEIVE	–	**SOURCE**. Direction of the data transmission. RECEIVE = Receiving MVB SEND = Sending MVB	–
2	ACT	User	1	B(r/w)	Element is **ACT**ive. 0 = Element is spare 1 = Element is active	–
19	BLOCKED	User	0	B(r/w)	**BLOCKED**. Cyclic execution of the specified command is: 0 = Not blocked 1 = Blocked	The cycle time is defined by the terminal SCAN_FTR.
22	SCAN_FTR	User	4	–	**SCAN F**ac**T**o**R**. In multiples of basic scan cycle time (default 1 second).	1..127
18	VALID	System	–	B(r/w)	**VALID** SOURCE = SEND: Set to 1 after the first execution of MVB. SOURCE = RECEIVE: Set to 1 after reception of DAT's. The terminal will be reset by the system if no DAT's are received within the supervision time of 3∗SCAN_FTR basic scan cycle time.	For MVB's with SOURCE= RECEIVE:.
24	ERR	System	–	B(r)	**ERR**or. Set if an error occurred. AC 400 sends a system message to indicate the nature of the problem. 0 = No error 1 = Error	–

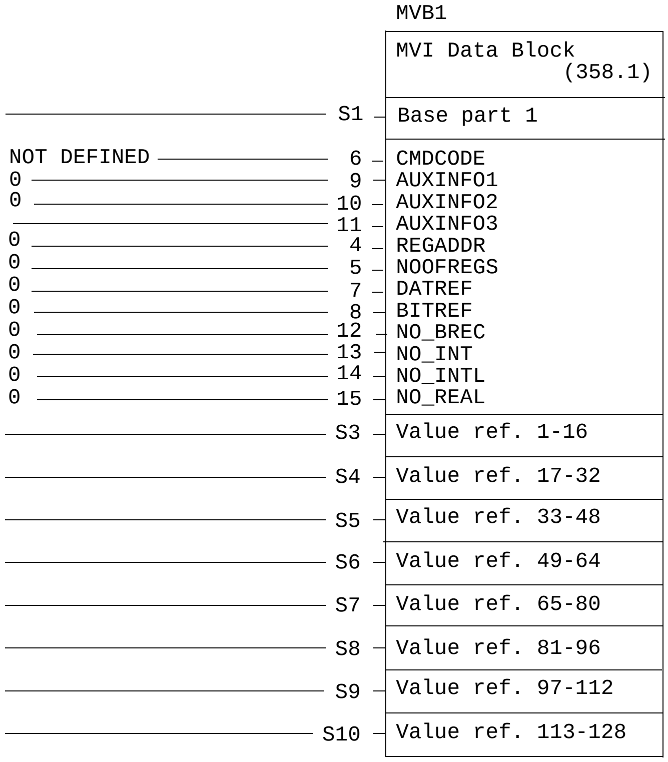


Figure 3-23. MVB Base Part 2

Table 3-12. Terminal Description of MVB for Base Part 2

Terminal No.	Terminal Name	Value entered by	Recommended Value	PC Connection Data Type	Description	Remarks
6	CMDCODE	User	-	–	**C**o**M**man**D** **CODE** to be executed. Master and Slave Mode: Restart Handler **Master Mode:** READ B: (Func 1) Read Coil Status READ B: (Func 2) Read Input Status READ I: (Func 3) Read Holding Registers READ I: (Func 4) Read Input Registers WRITE B: (Func 5) Force Single Coil WRITE I: (Func 6) Preset Single Register READ I: (Func 7) Read Exception Status WRITE B: (Func 15) Force Multiple Coils WRITE I: (Func 16) Preset Multiple Registers **Slave Mode:** WRITE B: (Func 1) Read Coil Status WRITE B: (Func 2) Read Input Status WRITE I: (Func 3) Read Holding Registers WRITE I: (Func 4) Read Input Registers READ B: (Func 5) Force Single Coil READ I: (Func 6) Preset Single Register READ B: (Func 15) Force Multiple Coils READ I: (Func 16) Preset Multiple Registers	Addresses See Table 3-14

Table 3-12. Terminal Description of MVB for Base Part 2 (Continued)

Terminal No.	Terminal Name	Value entered by	Recommended Value	PC Connection Data Type	Description	Remarks
9	AUXINFO1	User	-	IL(r/w)	**AUX**iliary **INFO**rmation **1** 0: Restart Handler 1: (Func 1) Read Coil Status 0: (Func 2) Read Input Status 1: (Func 3) Read Holding Registers 0: (Func 4) Read Input Registers 0: (Func 5) Force Single Coil 0: (Func 6) Preset Single Register 0: (Func 7) Read Exception Status 0: (Func 15) Force Multiple Coils 0: (Func 16) Preset Multiple Registes	0..2^{31} Only used in master mode.
10	AUXINFO2	User	-	IL(r/w)	**AUX**iliary **INFO**rmation **2** 0: Restart Handler 0: (Func 1) Read Coil Status 0: (Func 2) Read Input Status 0: (Func 3) Read Holding Registers 0: (Func 4) Read Input Registers 0: (Func 5) Force Single Coil 0: (Func 6) Preset Single Register 1: (Func 7) Read Exception Status 1: (Func 15) Force Multiple Coils 1: (Func 16) Preset Multiple Registers	0..2^{31} Only used in master mode.
11	AUXINFO3	User	–	A20(r/w)	**AUX**iliary **INFO**rmation **3** **Not** used for MODBUS.	Maximum 20 characters.
4	REGADDR	User	Small address model: 0001-0999 1001-1999 3001-3999 4001-4999 Large address model: 00001-09999 10001-19999 30001-39999 40001-49999	–	**REG**ister start **ADDR**ess. First register address to be transferred. See Table 3-14	0..2^{31}
5	NOOFREGS	User	Function code 1, 2 and 15: 1-2000 Function code 3, 4 and 16: 1-125 Function code 5, 6 and 7: 1	I(r/w)	**NO OF REG**iste**rS**. Number of registers to be transferred.	Only used in master mode.

Table 3-12. Terminal Description of MVB for Base Part 2 (Continued)

Terminal No.	Terminal Name	Value entered by	Recommended Value	PC Connection Data Type	Description	Remarks
7	DATREF	User	0	I(r/w)	**DAT REF**erence in this element (max 110 for BREC, INTL or REAL, 128 for INT DATs).	0..110 or 0..128 0 indicates that the terminal is not used. Only used in master mode.
8	BITREF	User	0	I(r/w)	**BIT REF**erence in the above selected DAT.	0..32 0 indicates that the terminal is not used. Only used in master mode.
12	NO_BREC	User		–	**N**umber **O**f **B**oolean **REC**ords DAT(B).	0..110
13	NO_INT	User		–	**N**umber **O**f **INT**eger records DAT(I).	0..128
14	NO_INTL	User		–	**N**umber **O**f **INT**eger **L**ong records DAT(IL).	0..110
15	NO_REAL	User		–	**N**umber **O**f **REAL** records DAT(R).	0..110

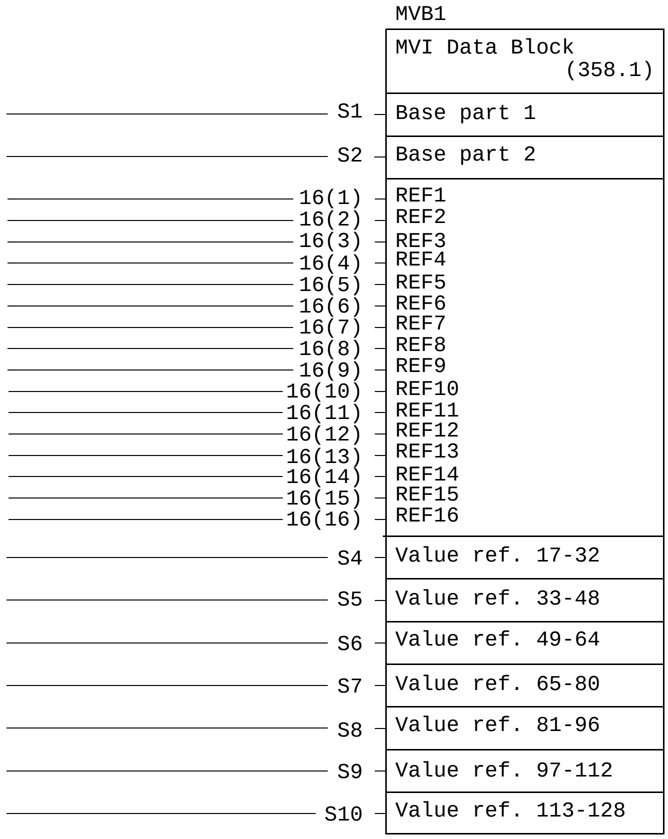


Figure 3-24. Value Reference 1-16

The value references 17-128 are analogous to Value ref. 1-16

Table 3-13. Terminal Description for MVB Value Ref. 1 - 128

Terminal No.	Terminal Name	Value entered by	Recommended Value	PC Connection Data Type	Description	Remarks
16(1)	REF1	User	-	–	**REF**erence: Name of connected DAT element (number **1**).	If an MVB has the name "MVB1" and NO_BREC or NO_INT has the value 1, the name of the connected DAT elements will be: MVB1.B1 or MVB1.I1
16(2)	REF2	User	-	–	**REF**erence: Name of connected DAT element (number **2**).	
:	:	:	:	:	:	
16(128)	REF128	User	-	-	**REF**erence: Name of connected DAT element (number **128**).	

Table 3-14. Allowed MODBUS Register Addresses

Function Code	Small Address Model	Large Address Model
1: Read coil status 5: Force single coil 15: Force multiple coils	0001 - 0999	00001 - 09999
2: Read input status	1001 - 1999	10001 - 19999
4: Read input registers	3001 - 3999	30001 - 39999
3: Read holding registers 6: Preset single register 16: Preset multiple registers	4001 - 4999	40001 - 49999

3.6.2.1 Command Code Usage

The CMDCODE terminal of the MVB data base elements, describes together with the AUXINFO1 and AUXINFO2 terminals the MVI-MODBUS function code.

3.6.2.2 Register Address Usage

The MVB data base element terminals REGADDR, NOOFREGS, DATREF and BITREF are used together to address all or part of the references held by a MVB data base element.

The terminal REGADDR is the address for the register held by the first DAT reference to an INT DAT or the first register (VALUE) of the first DAT reference to a BREC DAT.

The terminal NOOFREGS is the number of registers to read or write. NOOFREGS=0 (zero) is not allowed for a MVB data base element that is used for sending a command.

The terminal DATREF is the index of the first DAT reference to be read or written. DATREF=1 refers to the first DAT references of the MVB data base element. DATREF=0 indicates that this terminal is not used.

The terminal BITREF is the index of a boolean register (bit) within a BREC DAT. BITREF=1 in a MVB data base element which is configured for BREC DATs, refers to the first boolean register (VALUE) of the addressed BREC DAT. BITREF=0 indicates that this terminal is not used.

NOTE

NOOFREGS, DATREF and BITREF are only relevant for a MVB data base element which is used for sending a command to a node on the communication link. If BITREF is used, DATREF must also be used.

3.6.2.3 Data Transfer

The MVB data base element is used for transfer of data between nodes. It is used either to send a command and hold the data or only to hold the data. For a MVB data base element which is used to send a command, BLOCKED could be 1 or 0. If BLOCKED=1, the command is not sent cyclically and can be sent event driven by using the SENDREQ PC element.
If BLOCKED=0 (zero), the command will be sent cyclically with a cyclicity of the basic scan cycle time (default 1 second) x SCAN_FTR. For a MVB data base element which is only used to hold data, BLOCKED should always be set to 1.

ACT is used to activate/deactivate a MVB data base element. If ACT=0 (zero). The MVB data base element is deactivated and is considered to be spare in the data base. The MVB data base element is not sent and/or updated. If ACT=1 the MVB data base element is activated.
The MVB data base element could be sent and/or updated.

Advant Controller 400 Reads One INT from a Remote Node

Consider the communication between an Advant Controller 400 and a remote node where the Advant Controller 400 wants to read one INT from the remote node using MODBUS function code 3, see Figure 3-25. A MVB data base element will be used where CMDCODE= READ I, AUXINFO1=1, AUXINFO2=0, NOOFREGS=1 and SOURCE=RECEIVE.

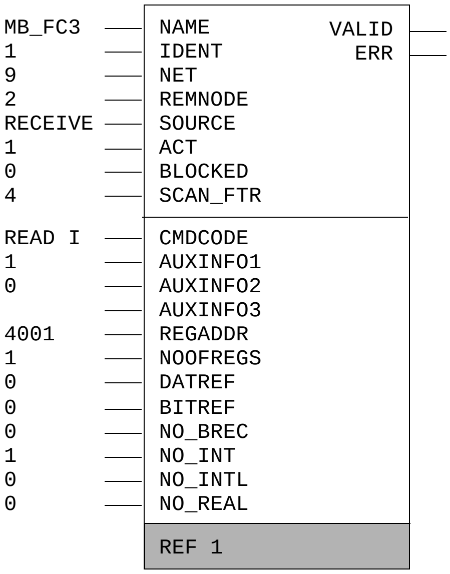


Figure 3-25. Advant Controller 400 Reads One INT from a Remote Node

Advant Controller 400 Writes One INT to a Remote Node

Consider the communication between an AC400 and a remote node where the AC400 wants to write an INT to the remote node using MODBUS function code 16, see Figure 3-26. A MVB data base element will be used where CMDCODE= WRITE I, AUXINFO1=0, AUXINFO2=1, NOOFREGS=1 and SOURCE=SEND.

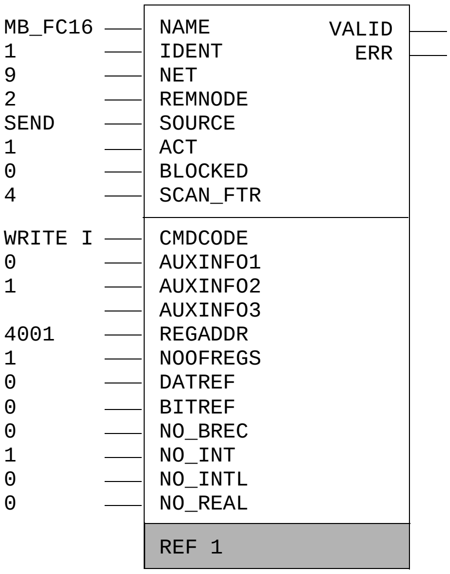


Figure 3-26. Advant Controller 400 Writes One INT to a Remote Node

Advant Controller 400 Writes the Last Ten INT References to a Remote Node

DATREF can be used to address part of the references in the command MVB DB-element, see Figure 3-27. In this example, AC400 uses MVI-MODBUS function code 16 to write the last 10 INT references, corresponding to register address 4011-4020, to the remote node. A MVB data base element will be used where CMDCODE= WRITE I, AUXINFO1=0, AUXINFO2=1, NOOFREGS=10, DATREF=11 and SOURCE=SEND.

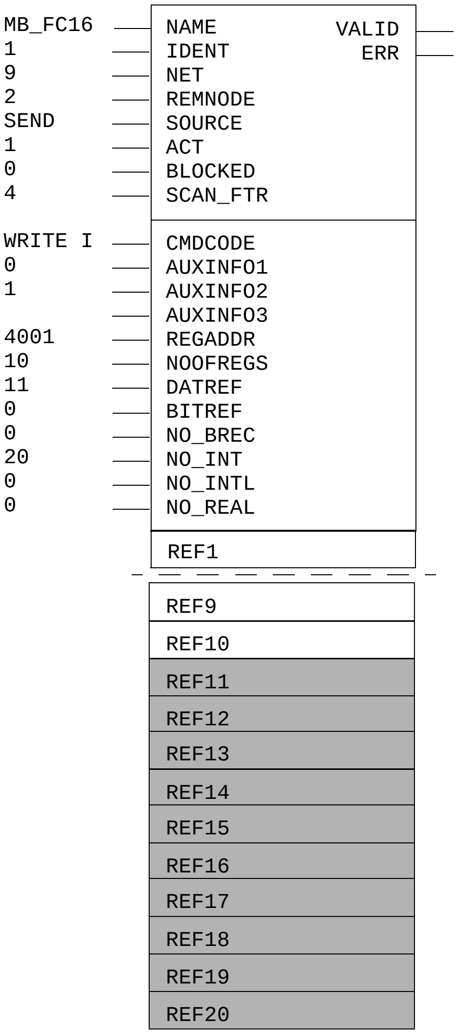


Figure 3-27. Advant Controller 400 Writes the Last Ten INT References to the Remote Node

Advant Controller 400 Writes the Last Ten Boolean Registers of the 11th Reference to the Remote Node

BITREF can be used to address certain boolean values (bits) of a reference in the command MVB data base element, see Figure 3-28. In this example, AC400 uses MVI-MODBUS function code 15 to write the last 10 boolean registers (bits) of the 11th reference, corresponding to register address 343-352, to the remote node. A MVB data base element will be used where CMDCODE= WRITE B, AUXINFO1=0, AUXINFO2=1, NOOFREGS=10, DATREF=11, BITREF=23 and SOURCE=SEND.

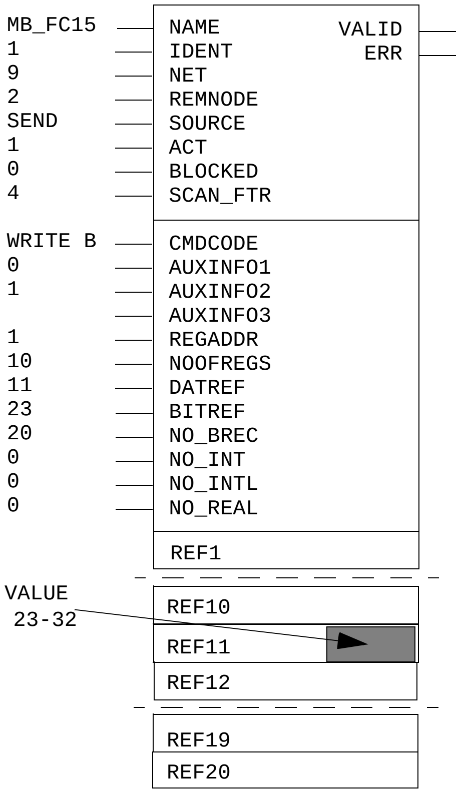


Figure 3-28. Advant Controller Writes the Last Ten Boolean Registers of the Reference to a Remote Node

3.6.3 Command MVB Data Base Elements used in Master Mode

This section describes the use of MVB data base element to control the data transfer in master mode. The Command MVB data base elements are only defined and used if CI534V02 operates as master on the MODBUS link. All Command MVB data base elements must be included in the send sequence according to Section 3.6.6.1, Type Circuits for MVI-MODBUS Data Flow Control.

These Command MVB data base elements are used by the application program to activate Read and Write Commands from CI534V02 to the corresponding slave unit.

3.6.3.1 Read Command

To update a value in Advant Controller 400, a Read Command must be issued to the corresponding slave unit. A number of MVB data base elements, configured to send MVI-MODBUS function codes 1, 2, 3 or 4, are used for this purpose. See Table 3-15.

Table 3-15. Configuration of MVB Data Base Element for MODBUS Read Function Codes in Master Mode

MODBUS Function Code	CMDCODES	AUXINFO1	AUXINFO2	AUXINFO3
1	READ B	1	0	Not Used
2	READ B	0	0	Not Used
3	READ I	1	0	Not Used
4	READ I	0	0	Not Used

The data returned by the slave unit is received by the MVB data base element and written to the corresponding DAT elements.

3.6.3.2 Write Command

To update a value in a slave, a Write Command must be issued to the corresponding slave unit. A number of MVB data base elements, configured to send MVI-MODBUS function codes 5, 6, 15 and 16, are used for this purpose. See Table 3-16.

Table 3-16. Configuration of MVB Data Base Element for MODBUS Write Function Codes in Master Mode

MODBUS Function Code	CMDCODES	AUXINFO1	AUXINFO2	AUXINFO3
5	WRITE B	0	0	Not Used
6	WRITE I	0	0	Not Used
15	WRITE B	0	1	Not Used
16	WRITE I	0	1	Not Used

The data sent to the slave unit is issued by the MVB data base element and fetched from the corresponding DAT elements.

3.6.3.3 Requesting Slave Status

It is possible to request slave status from a slave. This is done by means of a Read Status Command. A MVB data base element, configured to send MVI-MODBUS function code 7, is used for this purpose. See Table 3-17.

Table 3-17. Configuration of MVB Data Base Element for MODBUS Function Code 7

MVB Terminal	Value
CMDCODE	READ I
AUXINFO1	0
AUXINFO2	1
AUXINFO3	Not Used
REGADDR	0
NOOFREGS	1

The slave status information is received by the MVINODE data base element and updated in STATUS1 section VALUE17-VALUE24. see Section 3.6.1.2, MVINODE Data Base Element.

3.6.4 MVB Data Base Elements used in Slave Mode

This section describes the use of the MVB data base element for data transfer when CI534V02 is configured to act as a slave.

The MVB data base elements are used by the slave unit to hold data sent from or read by the master.

3.6.4.1 Read Commands from the Master

To read a value from a slave, a Read Command is sent from the master. A number of MVB data base elements, configured to hold data for this purpose, are used in the slave unit.
See Table 3-18.

Table 3-18. Configuration of MVB Data Base Element for MODBUS Read Function Codes in Slave Mode

MODBUS Function Code	CMDCODES	AUXINFO1	AUXINFO2	AUXINFO3
1	WRITE B	Not Used	Not Used	Not Used
2	WRITE B	Not Used	Not Used	Not Used
3	WRITE I	Not Used	Not Used	Not Used
4	WRITE I	Not Used	Not Used	Not Used

3.6.4.2 Write Commands from the Master

To update a value in a slave, a Write Command is sent from the master. A number of MVB data base elements, configured to hold data for this purpose are used in the slave unit.
See Table 3-19.

Table 3-19. Configuration of MVB Data Base Element for MODBUS Write Function Codes in Slave Mode

MODBUS Function Code	CMDCODES	AUXINFO1	AUXINFO2	AUXINFO3
5	READ B	Not Used	Not Used	Not Used
6	READ I	Not Used	Not Used	Not Used
15	READ B	Not Used	Not Used	Not Used
16	READ I	Not Used	Not Used	Not Used

The data sent from the master is received by the MVB data base element and written to the corresponding DAT elements.

3.6.5 MVB Data Base Elements for Control Commands

This section describes the use of the MVB data base element for Control Commands directed to CI534V02 itself in master and slave mode.

3.6.5.1 Restart Handler Command

To restart one communication channel, a restart handler command is sent from the application. A MVB data base element is used for this purpose. See Table 3-20.

Table 3-20. Configuration of MVB Data Base Element for Restart Handler Command in Master and Slave Mode

CMDCODE	AUXINFO1	AUXINFO2	AUXINFO3
RESTART HANDLER	Not Used	Not Used	Not Used

The network number (NET) is used to identify the communication channel which is to be restarted.

3.6.6 PC Program Layout

To control the data flow on the asynchronous communication link, you must build a PC program in the Advant Controller 400. The PC program receives status information from CI534V02. The flow control is maintained through a chain of SENDREQ PC elements, each corresponding to a Command data base element to be transmitted (see Figure 3-30).

Include all SENDREQ PC elements with Command data base element addressed to the same PLC in the same chain to ensure a correct flow control to the MVI-MODBUS link. Use the PC program to control the Command MVB data base element if CI534V02 is used in master mode. A PC program is not necessary in slave mode.

The cycle time of CONTRM should be approximately 100 ms.

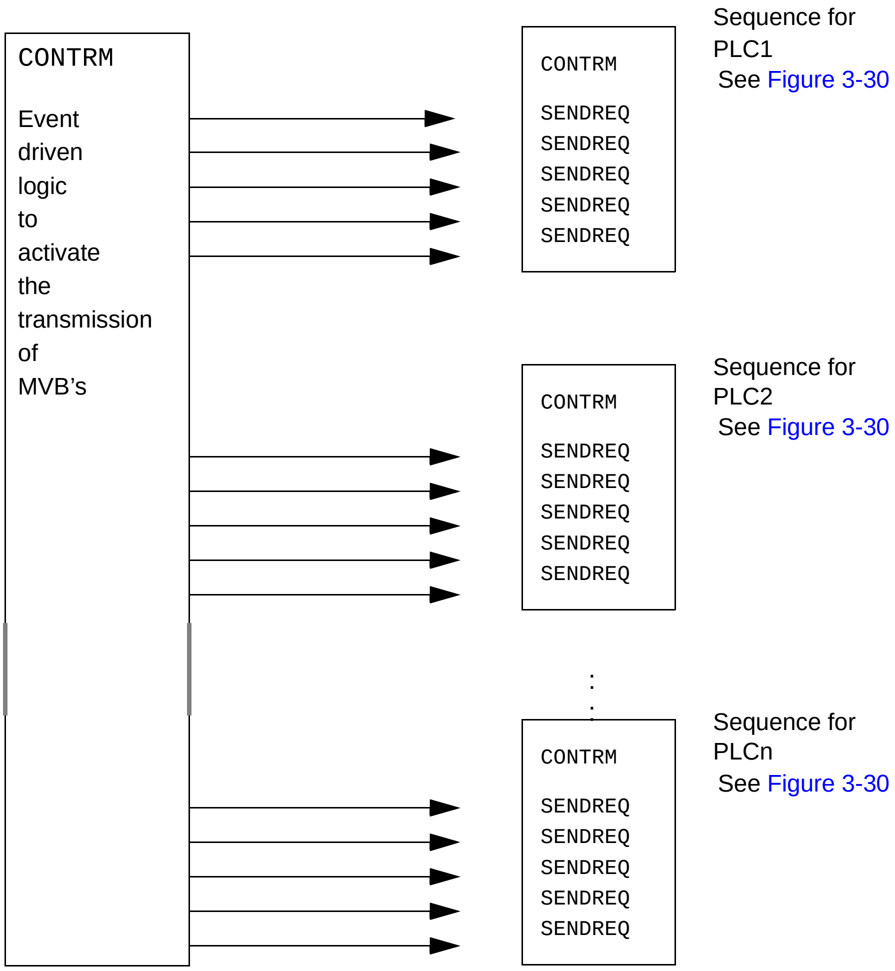


Figure 3-29. Overall PC Program Layout for MVI-MODBUS in Master Mode

3.6.6.1 Type Circuits for MVI-MODBUS Data Flow Control

Figure 3-30 shows a PC program type circuit which is used for data flow control on a MVI-MODBUS link. By linking several SENDREQ PC elements to each other with NXTBLK and PRVBLK, the order in which the MVB data base elements are activated can be controlled. By using Link Status and Ready for Message status bits from the MVINODE data base element to control the BLOCK terminal on the SENDREQ element, it can be assured that the CI534V02 submodule does not receive more messages than it can handle.

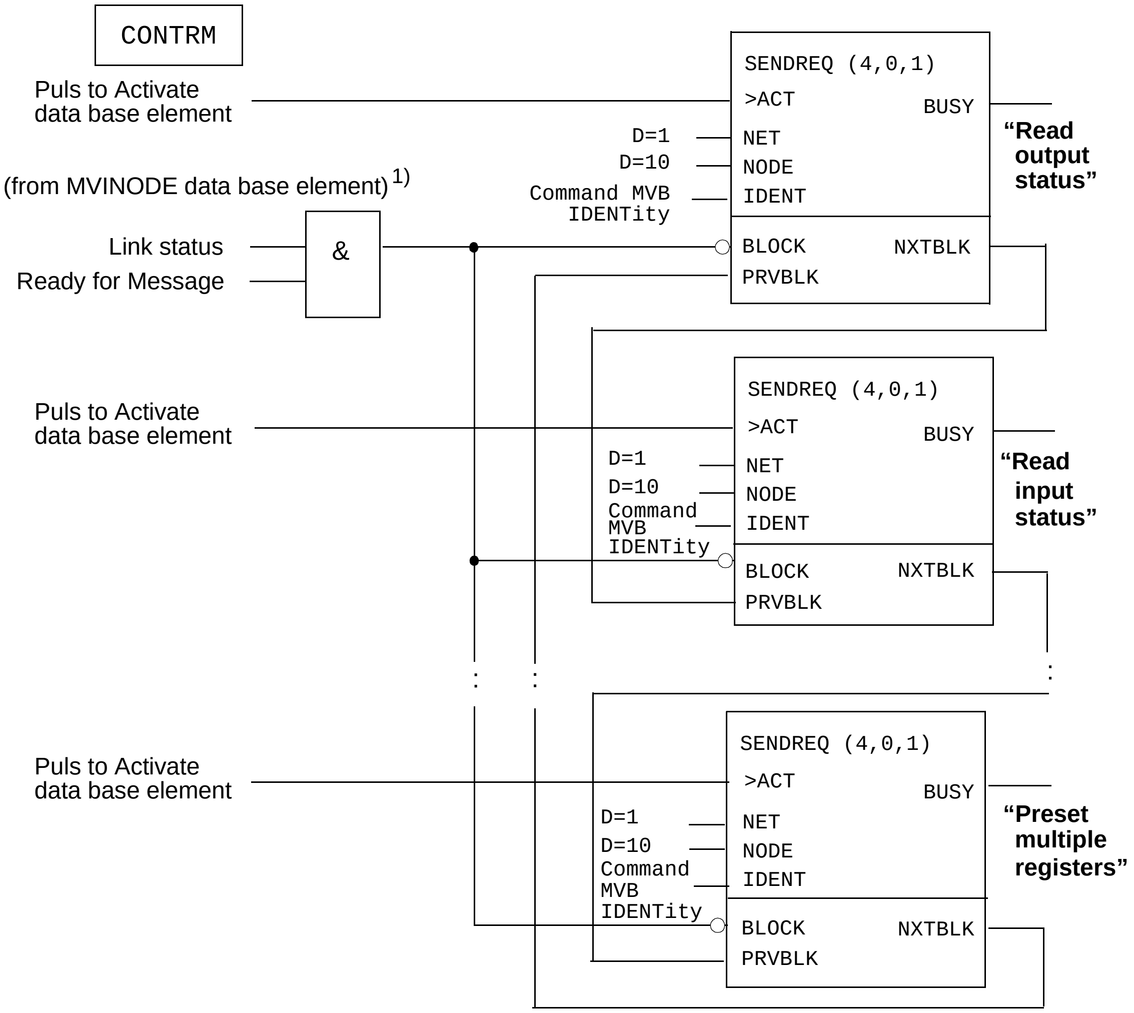
When ACT goes from 0 to 1, the MVB data base element with the identity given by NET, NODE and IDENT is activated once.

NXTBLK is true when sending of an MVB is in progress. When sending is completed, it is set to false. When no sending is in progress, NXTBLK follows the value of PRVBLK.

PRVBLK is used together with NXTBLK to control the activation of the MVB data base elements. No sending begins when PRVBLK is true. If sending orders are given at the ACT terminal during blocking by PRVBLK, the MVB will be activated when PRVBLK is set to false.

No sending takes place when BLOCK is true. If sending orders are given at the ACT terminal during blocking by BLOCK, they are ignored.

Flow control of activation of MVB data base elements is achieved by connecting the NXTBLK output of the first SENDREQ element to the PRVBLK input of next SENDREQ element. The NXTBLK output of this element is then connected to the PRVBLK input of the third SENDREQ element and so on. The NXTBLK output of the last SENDREQ element is connected to the PRVBLK input of the first SENDREQ element. Thus, the SENDREQ elements are connected in a chain, see Figure 3-30. With this PC program sequence, each SENDREQ element will activate its MVB data base element, one for each execution cycle, in the order they are linked together.


CONTRM
Puls to Activate data base element
(from MVINODE data base element) 1)
Link status
Ready for Message
&
SENDREQ (4,0,1)
>ACT
BUSY
D=1
NET
D=10
NODE
Command MVB IDENTity
IDENT
BLOCK
NXTBLK
PRVBLK
"Read output status"
Puls to Activate data base element
"Read input status"
Puls to Activate data base element
"Preset multiple registers"

[1] Status is fetched from the MVINODE data base element for the PLC (in this example node=10), see Section 3.6.1.2, MVINODE Data Base Element
Ready for Message = MVN1:VALUE6
Link status = MVN1:VALUE

Figure 3-30. PC Program Sequence for Control of MVI-MODBUS in Master Mode

Chapter 4 Runtime Operation

4.1 Operating Overview

Advant Controller 400 must be in operation mode (mode P1, indicated on the front of the main processor module) to communicate on the MVI-MODBUS link. With Advant Controller 400 in configuration mode (mode P2, indicated on the front of the main processor module), the communication is stopped.

After start-up, and with Advant Controller 400 in operation mode, you can perform the following operations:

- From the PC program for activation of commands and flow control
  - Activate/Stop sending of MVB data base element (Read, Write and Status Request command).
  - Re-initiate a channel on the CI534V02 submodule by sending a restart handler command.
  - Restart the CI534V02 submodule by setting/re-setting the terminal SERVICE on the MVIMOD data base element.
- The status information for a node on the MVI-MODBUS link in corresponding MVINODE data base element can be displayed.

4.2 Runtime Tutorial

A Runtime Tutorial is not included in this manual. The reader must be familiar with application commands in Advant Controller 400.

4.3 Operating Instructions

For a description of commands for control of the PC program and data base, please refer to *AMPL Configuration Advant Controller 400 Series Reference Manual*.

Chapter 5 Maintenance

5.1 Hardware Indicators

The CI534V02 submodule has two LED indicators on the front:

- The green LED is lit when the data base element MVIMOD for the CI534V02 submodule is correctly filled in, and the CI534V02 submodule has received the Configuration data base element for one port, see Section 2.2, Installation Procedures (the terminal IMPL and SERVICE must be set to 1 on the MVIMOD element).
- The red LED is lit when a fatal error is detected on the CI534V02 submodule. The LED is also turned on and off at a reset of the submodule.

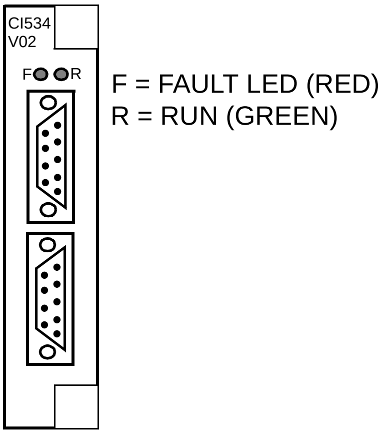


Figure 5-1. LED Indicators on CI534V02 Submodule

5.2 Error Messages

This part of the document lists all system messages that might be generated from the CI534V02 submodule. System messages from the Advant Controller 400 system software are not included. The MVI data base element task CXAX000 in the Advant Controller 400, can report a number of errors related to the MVI-MODBUS communication, for example, MVB not found, destination unreachable and so on.

For translation of system messages from the Advant Controller 400, please refer to the *Advant Controller 410 User's Guide* or *Advant Controller 450 User's Guide*.

The error codes indicated on the data base element MVIMOD is translated in the figure below.

Table 5-1. Error Codes from the Data Base Element MVIMOD

Error Code	Interpretation
21	Duplicate node number on the network
22	More than one node number in the station
23	Station connected to more than one Control Network
25	Network number already used in the Advant Controller
31	Module not found or internal bus error
32	Not correct hardware identity on module
33	Start up of module failed
34	Suspected hardware error
35	Not correct software identity on module
36	Not correct module interface identity
50	Illegal submodule number
51	Illegal module position
52	Module position number already used in the Advant Controller
53	Two modules has the same submodule number

System message printouts on the engineering station have the following appearance:

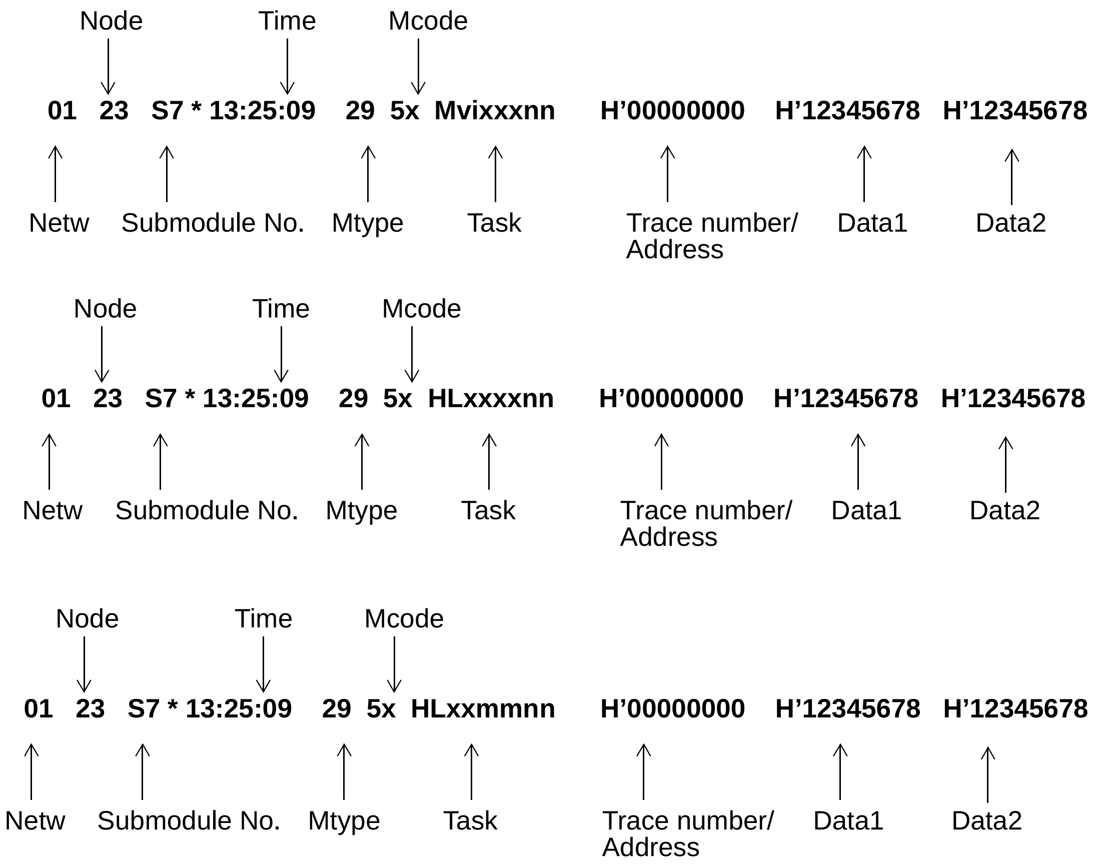

Node
Time
Mcode
01 23 S7 * 13:25:09 29 5x Mvixxxnn H’00000000 H’12345678 H’12345678
Netw
Submodule No.
Mtype
Task
Trace number/ Address
Data1
Data2
Node
Time
Mcode
01 23 S7 * 13:25:09 29 5x HLxxxxnn H’00000000 H’12345678 H’12345678
Netw
Submodule No.
Mtype
Task
Trace number/ Address
Data1
Data2
Node
Time
Mcode
01 23 S7 * 13:25:09 29 5x HLxxmmnn H’00000000 H’12345678 H’12345678
Netw
Submodule No.
Mtype
Task
Trace number/ Address
Data1
Data2

Figure 5-2. System Message Layout

All system messages have:

- Mtype = 29
- Task name = MVIxxxnn
  - xxx = Hdl if the MVI Protocol Handler reports the error
  - nn = 01 for port one
  - nn = 02 for port two.
- Task name = HLxxxxnn
  - xxxx = Setu if the MVI Setup task reports the error
  - xxxx = Wdog if the MVI Watchdog task reports the error
  - xxxx = Stat if the MVI Status task reports the error
  - xxxx = LCmd if the MVI Local command task reports the error
  - xxxx = LRsp if the MVI Local response task reports the error
  - xxxx = UCmd if the MVI Up stream command task reports the error
  - xxxx = DRsp if the MVI Down stream response task reports the error
  - nn = 01 for port one
  - nn = 02 for port two.
- Task name = HLxxmmnn
  - xx = DC if the MVI Down stream command task reports the error
  - xx = UR if the MVI Up stream response task reports the error
  - mm = node number, a decimal value.
  - nn = 01 for port one
  - nn = 02 for port two.

Table 5-2. Messages with Mcode = 54 and Task Name = MviHdlnn from CI534V02

Trace Number (Hexadecimal)	Parameter Description 1 = data1 2 = data2	Comments and Suggested Actions
00040005	1: File descriptor 2: -	Read from FIFO failed. Reset the MVI module, if the problem persists, please contact ABB.
00040006	1: File descriptor 2: -	Write to FIFO failed. Reset the MVI module, if the problem persists, please contact ABB.

Table 5-3. Messages with Mcode = 55 and Task Name = MviHdlnn from CI534V02

Trace Number (Hexadecimal)	Parameter Description 1 = data1 2 = data2	Comments and Suggested Actions
00010002	1: - 2: -	Failed to create UART device. Reset the MVI module, if the problem persists, please contact ABB.
00010003	1: File descriptor 2: -	Initiate UART failed. Reset the MVI module, if the problem persists, please contact ABB.
00010004	1: - 2: -	Failed to open UART device. Reset the MVI module, if the problem persists, please contact ABB.
00010009	1: File descriptor 2: -	Parameterize UART failed. Reset the MVI module, if the problem persists, please contact ABB.
0001000b	1: File descriptor 2: -	Failed to fetch event status from UART. Reset the MVI module, if the problem persists, please contact ABB.
0001000d	1: File descriptor 2: -	Failed to fetch modem status from UART. Reset the MVI module, if the problem persists, please contact ABB.
00020002	1: - 2: -	Failed to create watchdog timer device. Reset the MVI module, if the problem persists, please contact ABB.
00020004	1: - 2: -	Failed to open watchdog timer device. Reset the MVI module, if the problem persists, please contact ABB.
00020010	1: File descriptor 2: -	Failed to start watchdog timer. Reset the MVI module, if the problem persists, please contact ABB.
00040002	1: - 2: -	Failed to create FIFO device. Reset the MVI module, if the problem persists, please contact ABB.
00040004	1: - 2: -	Failed to open FIFO device. Reset the MVI module, if the problem persists, please contact ABB.
00040005	1: File descriptor 2: -	Read from FIFO failed. Reset the MVI module, if the problem persists, please contact ABB.

Table 5-3. Messages with Mcode = 55 and Task Name = MviHdlnn from CI534V02 (Continued)

Trace Number (Hexadecimal)	**Parameter Description** **1 = data1** **2 = data2**	**Comments and Suggested Actions**
00040006	1: File descriptor 2: -	Write to FIFO failed. Reset the MVI module, if the problem persists, please contact ABB.
0005000f	1: Requested block size 2: -	Failed to allocate memory. Reset the MVI module, if the problem persists, please contact ABB.
00050012	1: - 2: -	Select failed. Reset the MVI module, if the problem persists, please contact ABB.
00060013	1: Node number 2: -	Illegal node number. The node number requested was not configured. Check the configuration and command data base elements.

Table 5-4. Messages with Mcode = 56 and Task Name = HLSetunn from CI534V02

Trace Number (Hexadecimal)	**Parameter Description** **1 = data1** **2 = data2**	**Comments and Suggested Actions**
00020002	1: - 2: -	Failed to create a watchdog timer. Reset the MVI module, if the problem persists, please contact ABB.
00030002	1: - 2: -	Failed to create a transceiver channel. Reset the MVI module, if the problem persists, please contact ABB.
00030004	1: - 2: -	Failed to open transceiver channel. Reset the MVI module, if the problem persists, please contact ABB.
00030005	1: File Descriptor 2: -	Failed to read from the transceiver channel. Reset the MVI module, if the problem persists, please contact ABB.
00030006	1: File Descriptor 2: -	Failed to write to the transceiver channel. Reset the MVI module, if the problem persists, please contact ABB.
00030007	1: File Descriptor 2: -	Failed to close a transceiver channel. Reset the MVI module, if the problem persists, please contact ABB.
0003000f	1: Block size 2: -	Failed to allocate transceiver buffer Reset the MVI module, if the problem persists, please contact ABB.

Table 5-4. Messages with Mcode = 56 and Task Name = HLSetunn from CI534V02 (Continued)

Trace Number (Hexadecimal)	**Parameter Description** **1 = data1** **2 = data2**	**Comments and Suggested Actions**
00030016	1: - 2: -	Failed to get host information. Reset the MVI module, if the problem persists, please contact ABB.
00030023	1: Buffer pointer 2: -	Received illegal pointer from the Transceiver Interface. Reset the MVI module, if the problem persists, please contact ABB.
00040004	1: - 2: -	Failed to open FIFO pipe device to the protocol handler. Reset the MVI module, if the problem persists, please contact ABB.
00040024	1: File Descriptor 2: -	Ioctl on the FIFO pipe failed. Reset the MVI module, if the problem persists, please contact ABB.
0005000f	1: Requested block size 2: -	Failed to allocate memory. Reset the MVI module, if the problem persists, please contact ABB.
0005001f	1: - 2: -	Failed to spawn a task. Reset the MVI module, if the problem persists, please contact ABB.
00050025	1: Task Id 2: -	Failed to delete a task. Reset the MVI module, if the problem persists, please contact ABB.
00050026	1: - 2: -	Failed to create a semaphore. Reset the MVI module, if the problem persists, please contact ABB.
00050027	1: Semaphore Id 2: -	Failed to delete a semaphore. Reset the MVI module, if the problem persists, please contact ABB.
00050028	1: Semaphore Id 2: -	Failed to take a semaphore. Reset the MVI module, if the problem persists, please contact ABB.
00070015	1: DSX mcode number 2: -	Received illegal DSX signal from the Host. Reset the MVI module, if the problem persists, please contact ABB.

Table 5-5. Messages with Mcode = 56 and Task Name = HLStatnn from CI534V02

Trace Number (Hexadecimal)	Parameter Description 1 = data1 2 = data2	Comments and Suggested Actions
0003000f	1: Block size 2: -	Failed to allocate transceiver buffer. Reset the MVI module, if the problem persists, please contact ABB.
00030006	1: File descriptor 2: -	Failed to write to the transceiver channel. Reset the MVI module, if the problem persists, please contact ABB.
00030016	1: - 2: -	Failed to get Host information. Reset the MVI module, if the problem persists, please contact ABB.
00040004	1: - 2: -	Failed to open FIFO pipe device to protocol handler. Reset the MVI module, if the problem persists, please contact ABB.
00050028	1: Semaphore Id 2: Node number	Failed to take semaphore. If this is reported during restarts of the protocol handler, ignore it, else contact ABB.
00080023	1: Status Info pointer 2: -	Received illegal pointer from the protocol handler. Reset the MVI module, if the problem persists, please contact ABB.
00080013	1: Node number 2: -	The node number in the status information received from protocol handler is not valid. Reset the MVI module, if the problem persists, please contact ABB.

Table 5-6. Messages with Mcode = 56 and Task Name = HLWdognn from CI534V02

Trace Number (Hexadecimal)	**Parameter Description** **1 = data1** **2 = data2**	**Comments and Suggested Actions**
0003000f	1: Block size 2: -	Failed to allocate transceiver buffer. Reset the MVI module, if the problem persists, please contact ABB.
00030006	1: File descriptor 2: -	Failed to write to the transceiver channel. Reset the MVI module, if the problem persists, please contact ABB.
00030016	1: - 2: -	Failed to get Host information. Reset the MVI module, if the problem persists, please contact ABB.
00040004	1: - 2: -	Failed to open FIFO device Reset the MVI module, if the problem persists, please contact ABB.
00030004	1: - 2: -	Failed to open transceiver channel. Reset the MVI module, if the problem persists, please contact ABB.
00080023	1: Watchdog Info pointer 2: -	Received illegal pointer from the protocol handler. Reset the MVI module, if the problem persists, please contact ABB.

Table 5-7. Messages with Mcode = 56 and Task Name = HLLCmdnn from CI534V02

Trace Number (Hexadecimal)	Parameter Description 1 = data1 2 = data2	Comments and Suggested Actions
0003000f	1: Block size 2: -	Failed to allocate transceiver buffer. Reset the MVI module, if the problem persists, please contact ABB.
00030004	1: - 2: -	Failed to open transceiver channel. Reset the MVI module, if the problem persists, please contact ABB.
00030005	1: File Descriptor 2: -	Failed to read from the transceiver channel. Reset the MVI module, if the problem persists, please contact ABB.
00030006	1: File Descriptor 2: -	Failed to write to the transceiver channel. Reset the MVI module, if the problem persists, please contact ABB.
00030016	1: - 2: -	Failed to get Host information. Reset the MVI module, if the problem persists, please contact ABB.
00030023	1: Buffer pointer 2: -	Received illegal pointer from the Transceiver Interface Reset the MVI module, if the problem persists, please contact ABB.
00040004	1: - 2: -	Failed to open FIFO device Reset the MVI module, if the problem persists, please contact ABB.

Table 5-8. Messages with Mcode = 56 and Task Name = HLLRspnn from CI534V02

Trace Number (Hexadecimal)	**Parameter Description** **1 = data1** **2 = data2**	**Comments and Suggested Actions**
0003000f	1: Block size 2: -	Failed to allocate transceiver buffer. Reset the MVI module, if the problem persists, please contact ABB.
00030006	1: File Descriptor 2: -	Failed to write to the transceiver channel. Reset the MVI module, if the problem persists, please contact ABB.
00030016	1: - 2: -	Failed to get Host information. Reset the MVI module, if the problem persists, please contact ABB.
00040004	1: - 2: -	Failed to open FIFO device Reset the MVI module, if the problem persists, please contact ABB.
00080023	1: Response pointer 2: -	Received illegal pointer from the protocol handler. Reset the MVI module, if the problem persists, please contact ABB.

Table 5-9. Messages with Mcode = 56 and Task Name = HLDCmmnn from CI534V02

Trace Number (Hexadecimal)	**Parameter Description** **1 = data1** **2 = data2**	**Comments and Suggested Actions**
0003000f	1: Block size 2: Node number	Failed to allocate transceiver buffer. Reset the MVI module, if the problem persists, please contact ABB.
00030005	1: File Descriptor 2: Node number	Failed to read from the transceiver channel. Reset the MVI module, if the problem persists, please contact ABB.
00030006	1: File Descriptor 2: Node number	Failed to write to transceiver channel. Reset the MVI module, if the problem persists, please contact ABB.
00030016	1: - 2: -	Failed to get Host information. Check the configuration and command data base elements.
00030023	1: Buffer pointer 2: Node number	Received illegal pointer from Transceiver interface. Reset the MVI module, if the problem persists, please contact ABB.
0005000f	1: Requested block size 2: -	Failed to allocate memory. Reset the MVI module, if the problem persists, please contact ABB.
00050028	1: Semaphore Id 2: -	Failed to take semaphore. If it appears during protocol handler restart ignore it, else please contact ABB.
0006002b	1: Error number 2: Node number	Unexpected exception encountered. Reset the MVI module, if the problem persists, please contact ABB.
0007002a	1: Node number 2: -	Received more than allowed number of commands from the Host. Reset the MVI module, if the problem persists, please contact ABB.
00090013	1: Node number 2: -	Illegal node number. Reset the MVI module, if the problem persists, please contact ABB.

Table 5-10. Messages with Mcode = 56 and Task Name = HLDRspnn from CI534V02

Trace Number (Hexadecimal)	Parameter Description 1 = data1 2 = data2	Comments and Suggested Actions
0003000f	1: Block size 2: -	Failed to allocate transceiver buffer. Reset the MVI module, if the problem persists, please contact ABB.
00030006	1: File Descriptor 2: -	Failed to write to transceiver channel. Reset the MVI module, if the problem persists, please contact ABB.
00030016	1: - 2: -	Failed to get Host information. Reset the MVI module, if the problem persists, please contact ABB.
00040004	1: - 2: -	Failed to open FIFO pipe to the Protocol Handler. Reset the MVI module, if the problem persists, please contact ABB.
00050028	1: Semaphore Id 2: Node number	Failed to take node mutex semaphore. If it appears during protocol handler restart ignore it, else please contact ABB.
00080013	1: Node number 2: -	Illegal node number in the down stream response from the protocol handler. Reset the MVI module, if the problem persists, please contact ABB.
00080023	1: Response pointer 2: -	Received illegal pointer from the protocol handler. Reset the MVI module, if the problem persists, please contact ABB.
0008002c	1: Node number 2: -	Unknown response from the protocol handler. If it occurs immediately after node disconnect of the particular node ignore it, else contact ABB.

Table 5-11. Messages with Mcode = 56 and Task Name = HLUCmdnn from CI534V02

Trace Number (Hexadecimal)	**Parameter Description** **1 = data1** **2 = data2**	**Comments and Suggested Actions**
0003000f	1: Block size 2: -	Failed to allocate transceiver buffer. Reset the MVI module, if the problem persists, please contact ABB.
00030004	1: - 2: -	Failed to open transceiver channel. Reset the MVI module, if the problem persists, please contact ABB.
00030006	1: File Descriptor 2: -	Failed to write to transceiver channel. Reset the MVI module, if the problem persists, please contact ABB.
00030016	1: - 2: -	Failed to get Host information. Reset the MVI module, if the problem persists, please contact ABB.
00040004	1: - 2: -	Failed to open FIFO pipe to the Protocol Handler. Reset the MVI module, if the problem persists, please contact ABB.
00050028	1: Semaphore Id 2: -	Failed to take semaphore. If it appears during protocol handler restart ignore it, else please contact ABB.
00080017	1: - 2: -	Protocol handler illegally sent an upstream command, when one upstream command is already pending. Reset the MVI module, if the problem persists, please contact ABB.
00080023	1: Command Info. pointer 2: -	Received illegal pointer from the protocol handler. Reset the MVI module, if the problem persists, please contact ABB.

Table 5-12. Messages with Mcode = 56 and Task Name = HLURmmnn from CI534V02

Trace Number (Hexadecimal)	**Parameter Description** **1 = data1** **2 = data2**	**Comments and Suggested Actions**
0003000f	1: Block Size 2: -	Failed to allocate transceiver buffer. Reset the MVI module, if the problem persists, please contact ABB.
00030005	1: File Descriptor 2: Node number	Failed to read from the transceiver channel. Reset the MVI module, if the problem persists, please contact ABB.
00030006	1: File Descriptor 2: -	Failed to write to transceiver channel. Reset the MVI module, if the problem persists, please contact ABB.
00030023	1: Buffer pointer 2: -	Received illegal pointer from transceiver interface. Reset the MVI module, if the problem persists, please contact ABB.
00030024	1: Transceiver Channel File Descriptor 2: Node number	Ioctl operation on the high priority transceiver channel of the remote node failed. Reset the MVI module, if the problem persists, please contact ABB.
00050028	1: Semaphore Id 2: Node number	Failed to take semaphore. Reset the MVI module, if the problem persists, please contact ABB.
0005002d	1: Receiving Task Id 2: Signal number	Failed to send signal to the task Reset the MVI module, if the problem persists, please contact ABB.
0006002b	1: Error number 2: Node number	Unexpected exception encountered. Reset the MVI module, if the problem persists, please contact ABB.
0007002c	1: Node number 2: -	Illegal up stream response from Host. Reset the MVI module, if the problem persists, please contact ABB.
00090013	1: Node number 2: -	Illegal node number. Reset the MVI module, if the problem persists, please contact ABB.

Table 5-13. Messages with Mcode = 58 and Task Name = MviHdlnn from CI534V02

Trace Number (Hexadecimal)	**Parameter Description** **1 = data1** **2 = data2**	**Comments and Suggested Actions**
00010005	1: File Descriptor 2: -	Read from UART failed. Reset the MVI module, if the problem persists, please contact ABB.
00010006	1: File Descriptor 2: -	Write to UART failed. Reset the MVI module, if the problem persists, please contact ABB.
0001000b	1: File Descriptor 2: -	Failed to fetch event status from UART. Reset the MVI module, if the problem persists, please contact ABB.
0001000d	1: File Descriptor 2: -	Failed to fetch modem status from UART. Reset the MVI module, if the problem persists, please contact ABB.
0001000e	1: File Descriptor 2: -	Failed to cancel read descriptor. Reset the MVI module, if the problem persists, please contact ABB.
0001001e	1: File Descriptor 2: -	Failed to flush UART. Reset the MVI module, if the problem persists, please contact ABB.
00020004	1: - 2: -	Failed to open watchdog timer device. Reset the MVI module, if the problem persists, please contact ABB.
00020010	1: File Descriptor 2: -	Failed to start watchdog timer. Reset the MVI module, if the problem persists, please contact ABB.
00020011	1: File Descriptor 2: -	Failed to cancel watchdog timer. Reset the MVI module, if the problem persists, please contact ABB.
00050012	1: - 2: -	Select failed. Reset the MVI module, if the problem persists, please contact ABB.
00070014	1: PLC register address 2: Number of registers requested	Illegal register address. The register address has been used with wrong function code. Check the register addresses in your MVB data base element. See Table 3-14 for allowed register addresses.

Table 5-13. Messages with Mcode = 58 and Task Name = MviHdlnn from CI534V02 (Continued)

Trace Number (Hexadecimal)	**Parameter Description** **1 = data1** **2 = data2**	**Comments and Suggested Actions**
00070019	1: PLC register address 2: Number of registers requested	Illegal Data Request. The MVB must cover the address range specified by register address = DATA 1 and number of registers = DATA 2. Fill in the correct register address. Check the REGADDR and NOOFREGS in the MVB data base element, or the command from the PLC.
0007001a	1: - 2: -	Illegal data value reported from PLC (MODBUS Exception Response Code 3). The value referenced in the data field is not allowed in the slave.
0007001b	1: Function code 2: -	Illegal Function code reported from PLC (MODBUS Exception Response Code 1), or a Function code not supported by CI534V02 received from the PLC.
0007001c	1: - 2: -	Hardware error reported from PLC (MODBUS Exception Response Code 4 or 8).
0007001d	1: PLC register address 2: Number of registers requested	Illegal data address reported from PLC (MODBUS Exception Response Code 2). The address referenced in the data field is not an allowed address in the slave.

5.3 Fault Finding and User Repair

If you follow the instructions in Chapter 2, Installation and in Section 3.6, Configuration of MVI-MODBUS Application Data Base and PC program and still do not have a correctly working communication link, please check the following:

1. Are Modems and Cables correctly Set-up?

The CI534V02 must receive the correct modem signals. When you select full duplex mode for the modem signals, the signal Data Set Ready (DSR), Data Carrier Detect (DCD) and Clear to Send (CTS) must be set. In half duplex mode the DSR must be set and DCD and CTS toggle between 0 and 1.

Current DSR, DCD and CTS values are available in the data base element MVICHAN.

NOTE

Displayed values from the MVICHAN element on the engineering station are not always synchronized to the actual value change of the modem signals; short pulses may not be displayed.

The modem signals are set up by the modem or, in full duplex mode, you can wire them in the 9-position connector on cable TK577, or in the 9-position connector on the MVI side on cable TK595 (see Figure 2-7).

2. Is the MVIMOD Data Base Element correctly Filled in?

You must define the same node number for all the communication boards in an Advant Controller 400 node. All network numbers in the Advant Controller 400 node must be unique (for CI534V02 1-9).

POSITION and SUBPOS must match the actual position of the submodule. IMPLEMENTED and SERVICE must be set to one. CHANNEL1 and/or CHANNEL2 must refer to the correct MVICHAN element.

If the network number or node number for any of the communication modules in the Advant Controller 400 is changed after the start-up of the node, the Advant Controller 400 must be COLD STARTED. Connect an engineering station to the Advant Controller 400 and make a DUAP, press ENTER on the main CPU with start-up switch in “CLEAR” position and make a LOAP.

3. Check the Data Base and PC Program Application.

a. The Configuration data base elements (MVICHAN and MVINODE data base elements) must be built. The green LED on the CI534V02 submodule is lit when the configuration is successfully transferred to the module.

b. In master mode, the MVB data base elements must be built and the PC program with SENDREQ-elements for the flow control must be built and started.

c. In slave mode, the MVB data base elements for data transfer must be built.

4. Are there any System Messages reported in Advant Controller 400?

Check system messages by connecting an engineering station to the Advant Controller 400. Also check the system messages when you restart the CI534V02.

To restart the module, set the terminal SERVICE to 0 and back to 1 in the MVIMOD element. All configuration errors are reported at start-up. Error messages with Mtype 29 are translated in Section 5.2, Error Messages.

NOTE

Some errors are only reported once.

5. Which Status Bits are set in the MVINODE Data Base Elements, Section STATUS1?

VALUE (bit0) is set when the Advant Controller 400's connection to the PLC is established, see Table 3-9.

If you know the answers to the following questions, further analysis will be easier:

a. Are modems and cables installed as described in the *Advant OCS Installation Rules* manual? Pay particular attention to the power supply and connection to signal ground.

b. How is your control system configured? A block diagram with all node and network numbers is useful. Note also the type of PLC, the master and slaves on the link and the type of modem you are using.

c. Have you made any significant changes in your configuration (for example, new communication board(s) added, new modems)?

d. Is it possible to repeat your problem?

e. Have you found any way to circumvent the problem?

f. Have you made any other observations related to the problem?

A test tool for monitoring the status of the V.24 leads is also useful for further analysis. The test tool shows the status, with LED indicators, of the modem signals, data transmission (TD) and reception (RD). When an analysis of the data flow on the MVI-MODBUS link is necessary, you need a Serial Line Analyzer that monitors and stores the messages sent on the link.

Appendix A Hardware Module

A.1 CI534V02 - MODBUS Communication Interface

CI534V02 - MODBUS Communications Interface has:

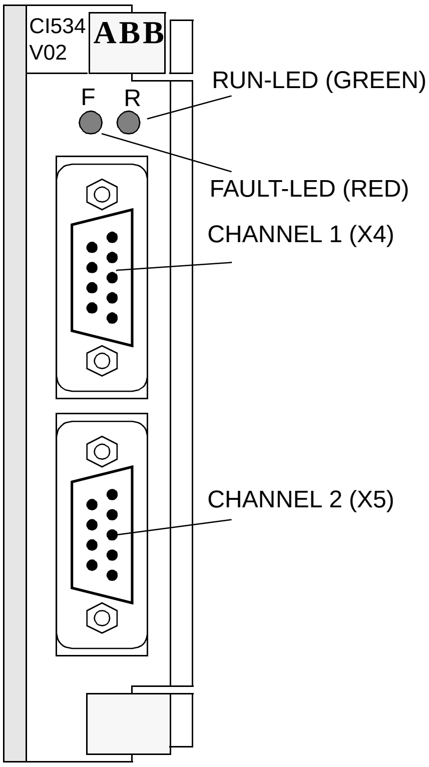
- Two RS-232-C communication interfaces
- Modem support.

Description

CI534V02 - MODBUS MultiVendor Interface is a submodule destined to the submodule carrier SC510 and SC520 in Advant Controller 450 and Processor Module PM150 in Advant Controller 410.
The two RS-232-C communication interfaces are used for communication with the Gould Electronics protocol MODBUS (RTU and ASCII). The communication channels support communication speed up to 19.2 kbit/s which is the limit set by the system software.
Both channels can run at this speed simultaneously.

The maximum communication distance without modems is 15 m.
The modem signals which are supported can be found in Table A-1 below.

Communication PINs are short circuit proof.



Front View

Technical Data

Indicators

LED R, Run (green) on module front. Indicating module running normally.

LED F, Fault (red) on module front. Indicating a fatal error detected on the CI534V02 module. The LED is also turned on and off at reset of the module.

Jumpers

The board contains one jumper for special purposes. In normal operation always keep the S1 in position 3 - 4 (“parking place”). The component and position indications are found on the printed circuit board.

Connectors

Serial channels 1 and 2 connectors (X4 and X5):

Connector type	9-pole male DSUB (DE9P)
Placement	On module front
Pin designation	See Table A-1 below:

Table A-1. Pin Designation for Channel 1 and 2, Connector X4 and X5

Pin	Short	Description
1	DCD	Data Carrier Detect
2	RD	Receive Data
3	TD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Ground
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear To Send
9	RI	Ring Indicator

Power Supply

5 V	typical max.	400 mA 670 mA
24 V	max.	40 mA
Power loss (heat)	typical	3 W

Mechanical Data

Module size:	The module occupies one submodule slot (H = 95 mm, L = 140 mm connectors not included).
Weight:	0.13 kg

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